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# POPULAR MECHANICS

MAY 1969  
50 CENTS

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Can the Eagles Do It Again?

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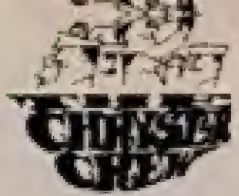
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- How to Handle 12 Camping Emergencies

- How to Camp Anywhere

- Pre-Trip Checkout

- What You Really Need in Camping Gear



## ON-THE-GO

# CAMPING

By DAN FALES, Outdoors Editor

# 69



This One



60RU-H9Z-ZUOK

TEAR OUT along perforated line—keep in glove compartment





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POPULAR MECHANICS



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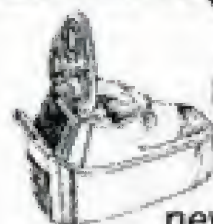
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Cover Photo by Don Pratt

*The BD-4, a four-place cabin plane you can build for \$3500.*

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The Night Jocko Clark Broke the Blackout: A great World War II painting.



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# LETTERS

TO THE EDITOR

## Better prepared for tornadoes

As Boone County Civil Defense Director, I found *Now You Can 'See' Tornadoes on TV* (page 93, March PM) of extreme interest.

On April 21, 1967, the city of Belvidere was hit by a tornado. Of the 24 people killed, 22 were school children. Scores of others were injured.

The tornado season is again approaching. I feel that the information in this article would be of great interest to the people of this area. I am sure that the residents could be better prepared in the event of another tornado.

I am asking permission to reprint the article for distribution at no cost to the residents of the area.

BELVIDERE, ILL.

CHARLES E. GRAVES

In our safety promotion effort here at NASA/MSFC/Michoud Assembly Facility, we are always alert to new and timely topics of interest and distribute such information to our employees.

Your permission to reprint this excellent article for our employees will be greatly appreciated.

NASA MICHoud ASSEMBLY FACILITY  
NEW ORLEANS, LA.

W.W. MOORE  
SAFETY OFFICER

*Permission granted.*

## Anyone for wild boating?

Come on now! Your *The Wildest Boat Trip in the World* (page 122, March PM) tells it like it is, and the pictures are good—but wooden boats have been carrying paying passengers through Grand Canyon since 1938. They still are; I've been running them for the last 12 years. This summer we're using them to retrace all of Major Powell's 1869 route from Wyoming to Nevada.

Martin Litton and I are the only wooden boat holdouts in an otherwise pontoon activity, but he sometimes forgets I'm around. Please tell your audience that I am.

MEXICAN HAT, UTAH  
MEXICAN HAT EXPEDITIONS

*Okay, we've told 'em—and now everybody who is anybody (that's our audience) knows you're there in Mexican Hat.*

## Those were the good old days

I'm an old-time auto nut, and I enjoyed

*(Please turn to page 8)*

POPULAR MECHANICS



# "Look who's smiling now!"

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## LETTERS

(Continued from page 6)

John Bentley's article, *So What Else Is New?* (page 114, Feb. PM).

I note a minor error—that Cadillac brought out its V8 engine in 1916. The 1914 Cadillac was the first to have a V8 engine; I remember it well.

I learned to drive in my father's 1911 Cadillac. Each of the four cylinders on its 30-hp motor was cast separately and had a copper water jacket. Kettering put his first electric starter on this model to try it out, and the starter was standard equipment on all 1912 Cadillacs. The 1913 Cadillac had a two-speed rear axle, but this had been patented by someone who sued General Motors and won because of their using this axle.

Many thanks to *Popular Mechanics* for helping make my retirement enjoyable.

LEXINGTON, KY. DON B. HARDING, MD

I can remember some of the old things they called autos. They may have had a lot of gadgets then, but the catch was they didn't work.

MANSFIELD, OHIO

C. B. BRUMELLE

### It's okay, girls

I know *PM* isn't exactly a woman's magazine, but I just had to comment on one article. *How to Spot a Bad House That Looks Good* (page 144, Feb. PM) was very helpful. Shall tear it out and save it for when I do buy a house.

Congratulations on a needed publication!

PEORIA, ILL.

JACKI LEWIS

*It's okay for girls to read PM. In fact, we even encourage it if you promise not to tear it up before your husband reads it. Otherwise, you foul up all our readership statistics.*

### Give us an inch . . .

I was amazed that the engines of *Those Small Sporty Sedans* (page 106, Jan. PM) with displacements of from 87.75 cubic feet to 121.4 cubic feet (see chart, page 109) should develop so little horsepower. I should think such burly motors would be real bombs!

NEW ALBANY, IND. W. H. McALLISTER

*We bombed that time. A foot in the mouth, so to speak. And while we're wearing the uncomfortable hair shirt, we'll confess that in the April PM we said in Build PM's 'Ground Hugger' (page 192) that the bike has a 90-inch frame. That's really the overall length of the bike. The frame itself is only 64 inches long.*

★★★

POPULAR MECHANICS



# take a giant step forward.

In college, take the step that puts you out in front. Take Army ROTC. Gives you a running start on whatever you decide to do. In the Army. Or in a civilian career.

Why? Simply because ROTC is a course in leadership. Broadens judgment. Builds acceptance for responsibility and develops maturity. You learn to motivate others, take charge of situations. When you graduate, you can fulfill your military obligation as an officer. You've taken command of your future . . . before someone else does it for you.

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DETROIT

# LISTENING POST

BY BILL KILPATRICK

**MID-ENGINE CARS** are more than mere exercises on design boards. Ford is said to have one ready for its 1971 model line-up—a sporty two-seater reminiscent of the Le Mans-winning GT-40. Car reportedly will feature a radically new engine, details of which include a new metal mix stressing high aluminum content, pistons in a novel arrangement, mounting at a 45°-plus angle.

American Motors recently sent out photos of a sporty mid-engine prototype tabbed “a design study car.” Don’t believe it; if the “ohs” and “ahs” of auto-show audiences and others who see the car have the proper ring (i.e., they sound like money panting to be spent), AMC has a “go” button ready to be pushed. Car could bow as a ’71 or ’72.

Chrysler and GM also have mid-engine designs in the works, are said to be looking towards ’72 or ’73. In any event, the concept seems the way to go for sporty cars in the 1970s.

**A MAJOR BATTLE** is shaping up between automakers and oil companies, the big issue at stake being just who, and to what extent, is going to invest the millions necessary to bring about dramatic reductions of car-caused air pollution. The auto companies claim great strides in air pollution reduction could be brought about with the marketing of low-volatility gasoline. But the oil companies say more efficient engine design and antismog add-ons by automakers is the way to go. Both are right, yet both are reluctant to go bucks-up for the necessary engineering and production-line changes, or changeover of present refining processes. Squabble could get noisy as sides trade “holier than thou” allegations. Then both will express “shock, surprise” when Big Daddy (the government) steps in and tells ’em what they’re going to have to do.

**FIRST UNITS** of Dodge’s new Challenger are due off the production line this month. The car, a GT-ish affair with pronounced European accents, will bow with the early fall introduction of the 1970 models, will be aimed at the upper range of the Mustang/Camaro/Firebird market. Car is Chrysler’s “about time” answer to the Mustang, will have to fight to first grab and then maintain a foothold in an admittedly highly competitive market arena. Some observers say car is too little, too late, others that it’s an eye-popper certain to attract buyer attention, carve a market niche for itself.

**DRIVING WITH YOUR PARKING LIGHTS ON** could considerably enhance your overall driving safety. A recent test involving vehicles operated by the Port of New York Authority indicated that running with the parking lights on seemingly reduced accidents, particularly rear-end collisions. Not only that, but what accidents *did* occur were less severe than those befalling the Authority’s unlighted vehicles. Louis Bender, Authority traffic engineering chief, said he thought the experiment proved existing cars need better daylight definition, particularly when—as in a major metropolitan area—vehicle colors can blend easily into the background. Bender also said he thought running with parking lights on improved the depth perception of other motorists. Upshot of the test is that the Authority is modifying all its vehicles so that parking lights will go on whenever the ignition is turned on.

During a recent trip to Sweden, in the course of which we drove many miles over both major and minor roads, we noted the Swedes tend to run with their parking lights on, something we found a positive aid to our driving in that it increased our awareness of other vehicles on the road, made it easier to determine suitable distances between ourselves, others.

**A NEW IDEA IN TIRES** is being marketed by Uniroyal—tires designed differently  
[\(Please turn to page 14\)](#)



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*makes it  
easy*



# Goodyear introduces tire for pickups



We gave it the name  
Custom Xtra Grip—  
Wide Tred.  
It earned the  
“high-performance”  
tag for itself...in  
this endurance run  
at Goodyear’s  
San Angelo  
test track.



# a high-performance and panels



What does "high-performance" mean?

It means enough strength to run 4000 miles at 85 mph with an overload of up to 15%.

Something you wouldn't normally do in your own pickup.

But we did it to test the new Custom Xtra Grip—Wide Tred\* at the Goodyear proving ground in San Angelo, Texas.

It has a wider, flatter tread designed to

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So it'll act like a new one longer.



**The other CD-2.** We also make a CD-2 that stops oil burning in older cars. So be sure and get the right one. It may be confusing, but one kind couldn't do both jobs.



## DETROIT LISTENING POST

(Continued from page 10)

and specifically for the front and rear wheel of the same car. Called Uniroyal Masters, the tires are designed to perform different functions—the fronts to steer, the rears to propel the car. The uniform-tread front tires are the new 78 series (left in photo), nearly one inch wider than conventional boots. The rear tires are the lower, wider series 70 shape (right)—almost two inches wider than conventional tires—and feature an asymmetrical tread. On the inside of the rear tire tread



are three rows of a special high-traction lug design, on the outside five rows of regular all-weather rib pattern. Uniroyal says the tread wear of the matched sets is so good it's offering Masters with a 40,000-mile guarantee.

What do you do with, say, a Toronado? You put front Masters all around.

### NEW TRAFFIC HAZARD SIMULATOR

is being championed in the U.S. by Renault. Designed and developed by California Automotive Research, of Newport Beach, the new device features three pylon-defined traffic lanes, each monitored by a conventional red/yellow/green traffic light. When an approaching driver crosses a trip line, a predetermined light pattern flashes to simulate unexpected hazards, indicate an escape route. For example, one lane may flash red, one yellow, one green. Driving down the red lane is the equivalent of hitting an obstacle head-on, the yellow lane dangerous, the green lane safe. Should all three lanes flash red, a driver is required to come to a complete stop before reaching the front line of pylons. Purpose of the device, which can be set up in big parking lots, drag strips—any wide stretch of road—is to test and improve driver reaction time to unexpected, yet typical, traffic situations. ★★



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When you read the papers you see there's a strike here, a lockout there, Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstery, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.

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New way to prevent cavities is with a laser beam. The technique involves coating a tooth with a sodium solution, then glazing it with a laser blast of 20-billionths of a second duration. Result: The tooth's enamel is permanently hardened and sealed by the almost instantaneous laser heat, making it highly resistant to decay. The technique has already been used on human patients, according to Dr. Fred M. Johnson of Electro-Optical Systems, Pasadena. There is no pain and no injury to tooth pulp or to the patient's mouth. Within two years, predicts Dr. Johnson, "glazers" will appear in some dental offices.

Omega, called the world's first global, all-weather navigation system, is being set up by the Navy. It uses eight transmitting stations spotted around the earth so that a ship, no matter where it is, can always pick up signals from three towers and get a fix. Said to be accurate within one mile, Omega outperforms other systems because its low-frequency signals travel up to 6000 miles without much distortion, even through bad weather. Omega already is in use in the North Atlantic and parts of the Pacific. By 1972 it should be in worldwide operation. Omega is being made available to ships and aircraft of all nations.

A rare weed that poses a threat to western ranges is under study by Department of Agriculture scientists. It's identified as a fertile hybrid of two common range weeds—halogeton and Russian thistle—and was first discovered six years ago near Patter Spring, Utah. The original patch spread so that the weed now is found in a 7 by 30-mile area. The hybrid is a harsh, thorny plant that contains poisonous oxalic acid. Livestock generally will not eat it, though they find Russian thistle partially palatable.

"Moon mud" may be the next cure-all peddled by quacks once our Apollo astronauts return from a lunar landing. That warning comes from an Arthritis Foundation spokesman who notes that health charlatans usually try to capitalize on well-known accomplishments of scientists.

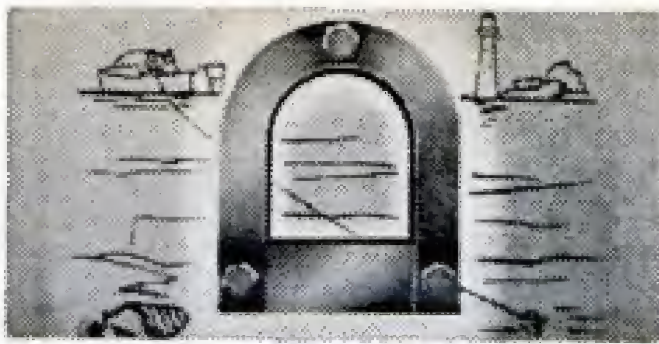
Quick recognition of friendly ground troops is a problem for combat pilots. The Army and RCA's radar division are working on a lightweight interrogator-transponder system that might do the trick. Here's how it's designed to work: The airborne interrogator transmits a coded signal to the ground, where a companion transponder, small enough to be handheld by a soldier, recognizes the signal and answers by automatically sending back a coded signal of its own. The system would be a boon to helicopter pilots looking for safe drop zones and landing areas.

For the first time, a pulsar has been put on film. That feat was accomplished recently when astronomers at the Lick Observatory, near San Jose, Calif., turned their 120-inch reflector telescope on the Crab Nebula. Equipped with a light-amplifying TV camera, the 'scope was zeroed-in on a spot associated with strong, 33-times-a-second radio pulsations. The videotape revealed a blinking light source (33 blinks per second) that had been associated with an observable star. The blinking had not been detected before because it is too fast for the human eye, causing the star to appear as a steady light source. Using special gadgetry, the astronomers succeeded in "slowing" the pulsations on the tape. The discovery adds to the picture but doesn't explain the nature of the mysterious pulsars.

The "pill" is still a controversial method of contraception. Two recent unpublished studies, according to *Medical World News*, a professional publication, indicate that among women who have taken the pill for several years there is a significantly higher incidence of cervical cancer than among women who use a diaphragm. However, two other investigations don't implicate the pill, according to the magazine. So far, all of the evidence is sketchy and inconclusive.

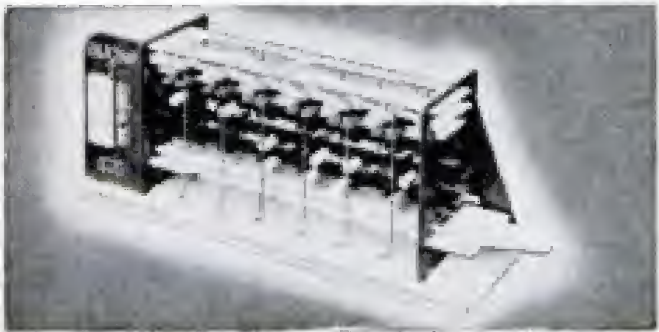
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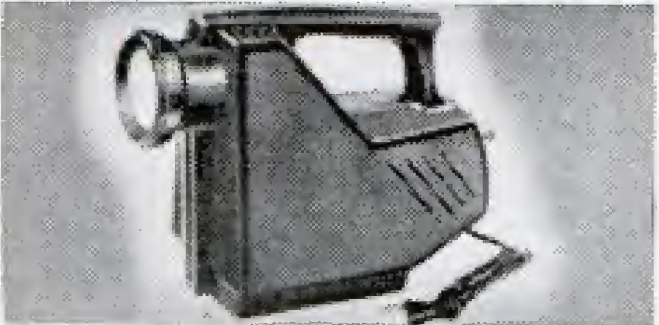
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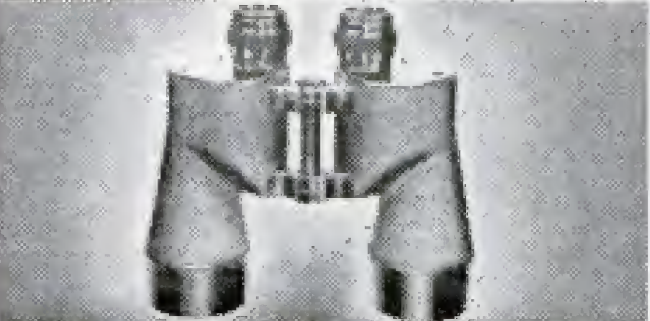
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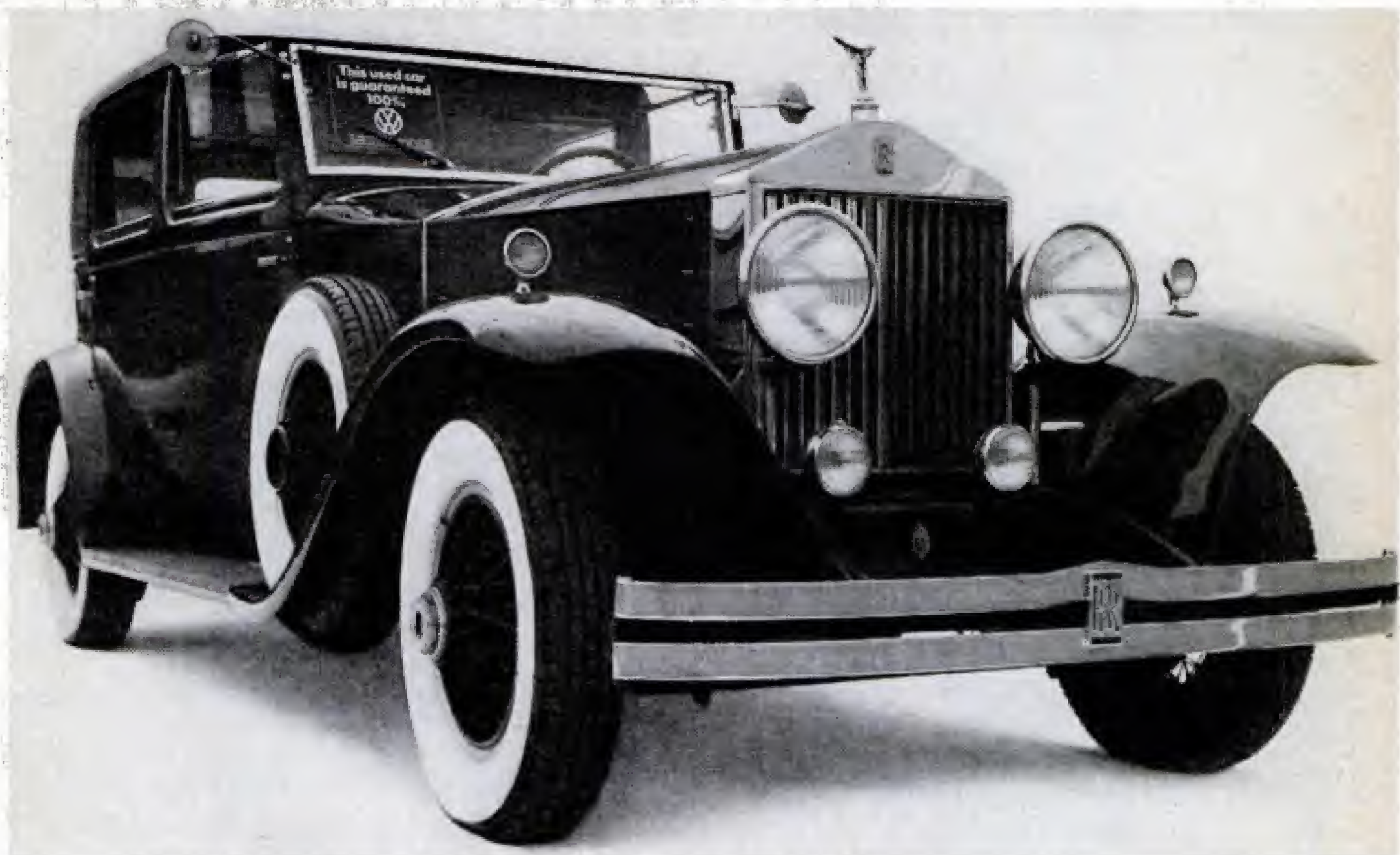
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# Drivin' with Dan

Why did you withdraw from F-1 racing? How is average speed figured for a race course? Will accelerating on curves help make them? What helmet do you wear? Dan Gurney answers these and other automotive questions



**A FAMILIAR SCENE** for Dan—being interviewed at Indianapolis. It'll be more of the same this month as Dan and his crew gird for the annual 500-mile grind

**Q.** Have you ever tested the Shelby Cobra? What did it do?—John Fevola, Brooklyn, N.Y.

**A.** I drove the original roadster prototype at Riverside, and I've raced them at Sebring, Le Mans, the Targa Florio in Sicily and Daytona. In fact, I assisted in the development of the car. I raced the coupe at Sebring, Daytona, Le Mans (where Bob Bondurant and I won the GT category in 1964), finishing fourth overall. They were great fun to drive, but rough as the devil and very noisy.

**Q.** Why did you withdraw from Formula 1 racing? Do you plan to return?—Steve Murray, Garden Grove, Calif.

**A.** Frankly, the financial and man-hour burdens were so great that we had to stop either Indy, Can-Am or F-1 racing. Economically, F-1 is the lowest-paying, most expensive of the three, and, because of the increased international participation in Can-Am and Indy, the prestige of F-1 is no longer as great as it used to be. The choice was pretty easy to make. I wish that there was more money in F-1 racing.

**Q.** What was your first stock-car race, and how did you do?—Steve Ford, Des Moines, Iowa.

**A.** My first stock-car race was in 1958 on a road course at Meadowdale, Ill. Most of the big names of the day were there. I drove a '58 Ford. The deal was arranged by Jerry Unser (Louie, Bobby and Al's older brother) through our mutual friendship with former Indy winner Troy Ruttman. Bob Rose and Lou Sipolt were the mechanics (their first road race, too). I went from 28th to second, right behind the eventual winner—Fred Lorenzen—before the center of the clutch dropped out.

**Q.** Do you plan to stick with the pushrod stock-block Ford at Indy this year, or will you use the DOHC Turbo-Ford? Also, have you ever raced on the dirt?—Bill Chester, Oak Park, Ill.

**A.** I plan to stay with our pushrod stock-block Ford, but we also expect to have a car ready with a turbo DOHC. I expect our new pushrod to be quite a bit faster, as our development department has found a significant increase in hp over last year's version. No, I haven't raced on the dirt, though I love to drive or ride a motorcycle on it.

**Q.** On a race course, how is the average speed figured?—Mike Whitsitt, Lufkin, Tex.

**A.** First, you must know the distance traveled  
([Please turn to page 28](#))



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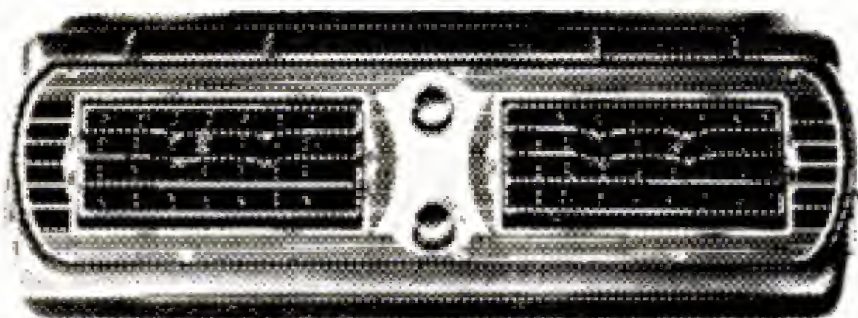


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## DRIVIN' WITH DAN

(Continued from page 24)

in making one lap. It doesn't matter whether it's a road circuit or an oval. Then, with a timing device, it is a matter of simple arithmetic. For example, a lap run in one minute around a two-mile circuit equals an average speed of 120 mph; in 45 seconds, 160 mph; in 40 seconds, 180 mph; in 30 seconds, 240 mph, and so on.

**Q.** In an Indy race, which block can live the longest in the heat—aluminum or cast iron?—Thomas Butchor, Albany, Calif.

**A.** That's a real tough one. I think it really depends on the design rather than the material. Iron is less expensive and slower, aluminum more expensive and faster. Both should have adequate life if designed properly.

**Q.** Do you think the Ford Cosworth F-1 engine is the ultimate in three-liter engines?—Kevin Cowley, New Zealand.

**A.** I'd say it was the best one in racing in 1968. But to call it the "ultimate" would be going too far.

**Q.** Will you be running the Indy championship trail or the NASCAR trail in 1969?—Ken Burbeck, Huntington Beach, Calif.

**A.** Indy, championship road races and Can-Am.

**Q.** What is the difference in driving techniques for a turbine as opposed to a piston engine?—Randy Ziemann, Fairmount, Minn.

**A.** Driving a turbine, you must plan ahead much more. You get very little help in slowing the car down by letting off on the throttle. So brakes play a much more important part in driving technique. The throttle response still has a lag which is longer than a piston engine, though not much different than a turbocharged piston engine. In all, it requires an entirely different technique.

**Q.** What is this new-type crash helmet you're wearing?—Don Stevens, Milwaukee, Wis.

**A.** It's called the Bell "Track Star" or "Star." It's stronger, gives you much more face protection. Dirt, stones or pebbles don't bother

(Please turn to page 32)

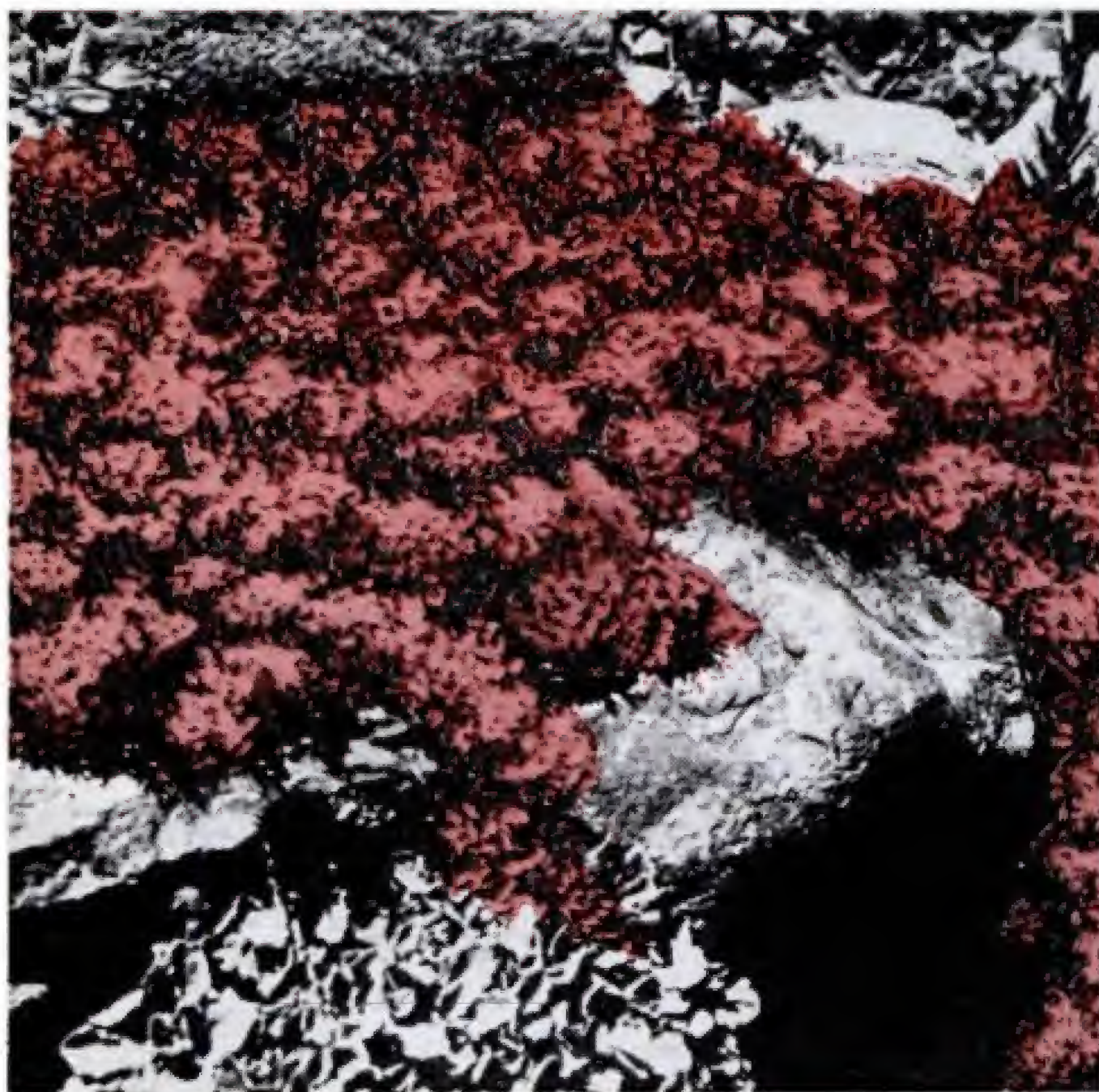


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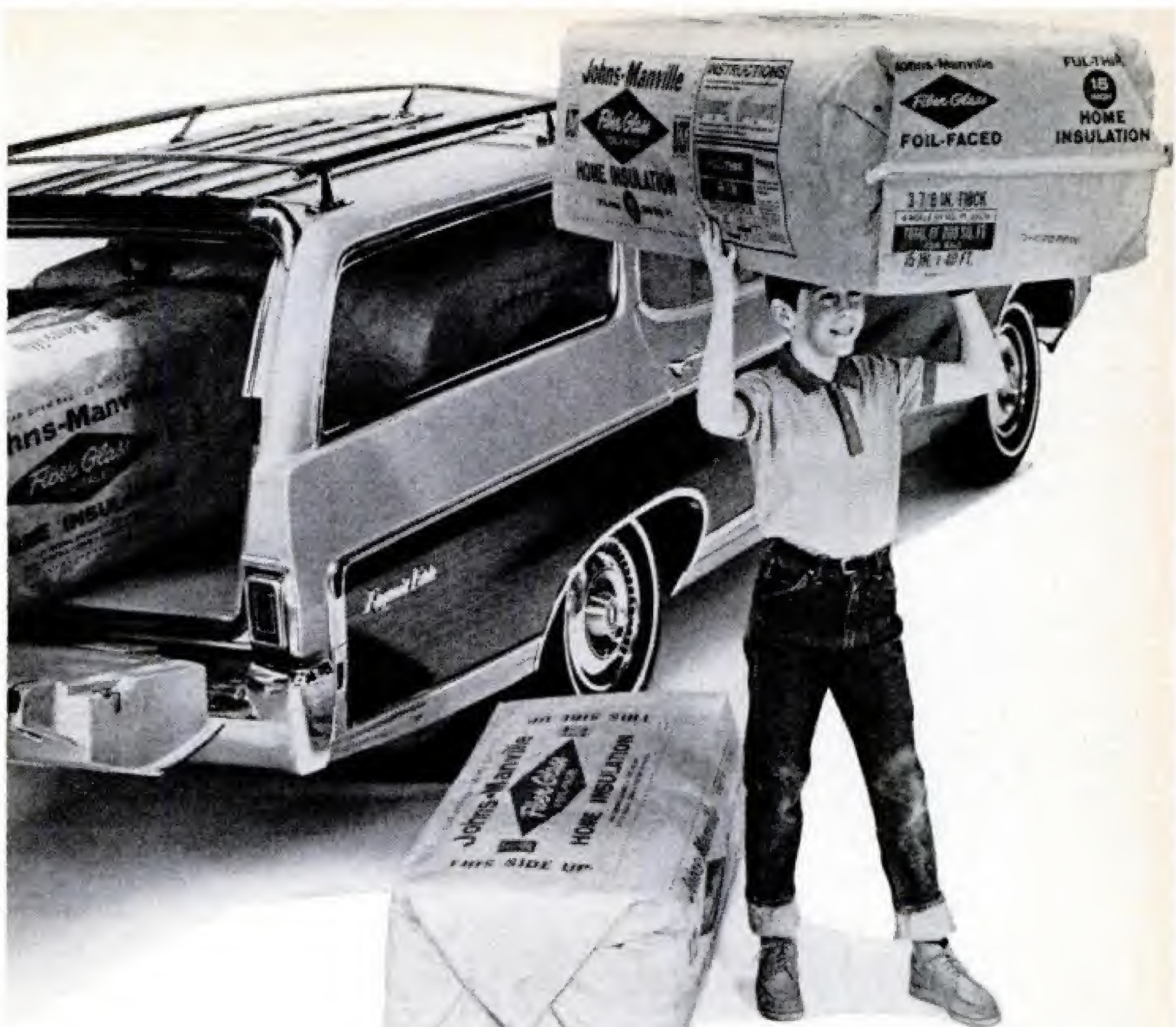
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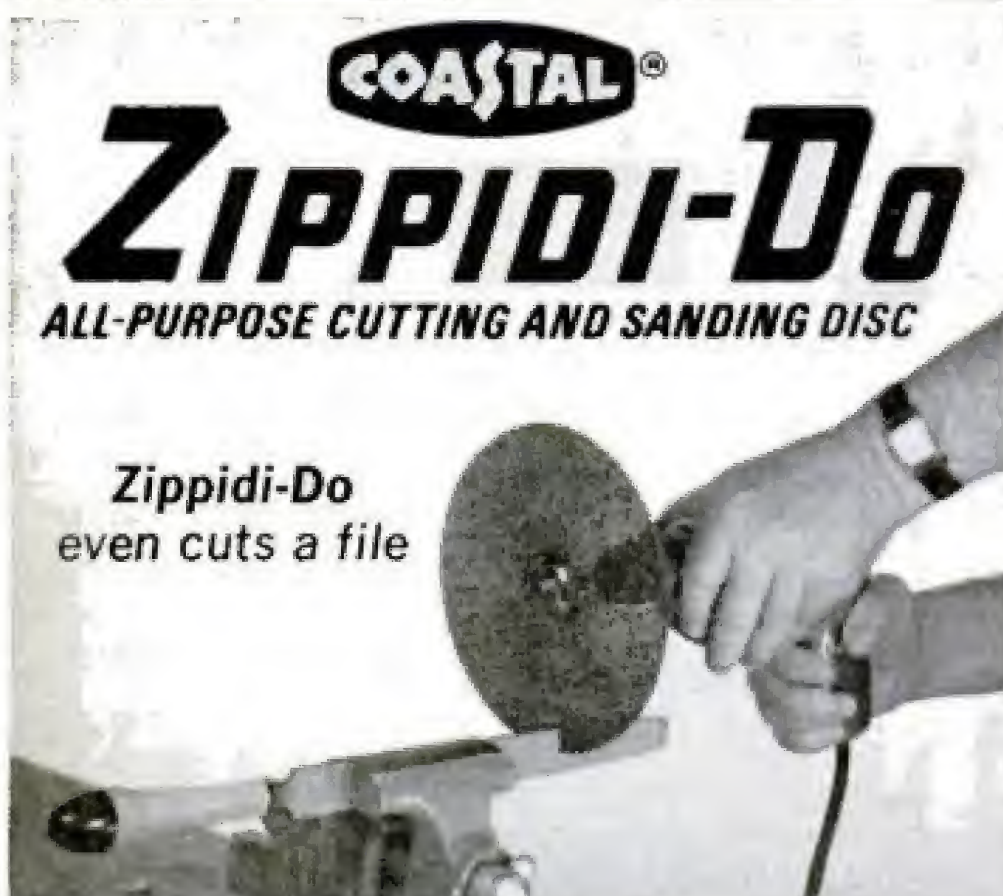


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## DRIVIN' WITH DAN

(Continued from page 28)

you as much. It's like driving a very small coupe. It was first used on motorcycle dirt tracks. I like it very much.

**Q.** Is power steering used on race cars?—Mike Mileski, Akron, Ohio.

**A.** Not very often. There have been examples of power steering on championship dirt-track cars, but it's not very common.

**Q.** How do you think an American Motors Rebel would stand up as a racing stock car?—Ricky Mariano, West Chester, Pa.

**A.** Probably it would be fine by the time the car was modified to fit stock-car racing rules. Most of the cars are running with special components, anyway.

**Q.** What condition was your winning car in at the end of last year's Rex Mays 300? Did you still have brakes and gas?—Lee Godfrey, Tonawanda, N.Y.

**A.** Engine okay, brakes bad, rear suspension broken, gas down to four gallons, everything very dirty, but crew and driver very happy.

**Q.** I've been wondering if your height has ever had any effect on your driving or has caused you any trouble.—James Doucett, Hudson, Ohio.

**A.** Yes, it has caused a lot of hassles. I never seem to be able to get into someone else's car without going through the rigmarole of seat changes, windshield changes and pedal changes. Some mechanics get mad at me, and generally it is just some added work for everyone. But, where there's a will, there's a way.

**Q.** I would like to build a go-kart with a V8. What problems would I run into?—Mike Layden, Franklin, Pa.

**A.** Mainly, staying alive.

★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 74).





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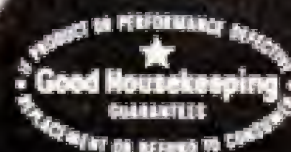
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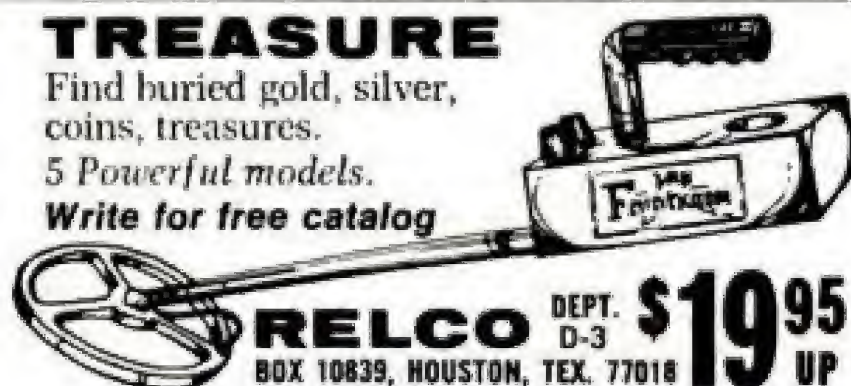
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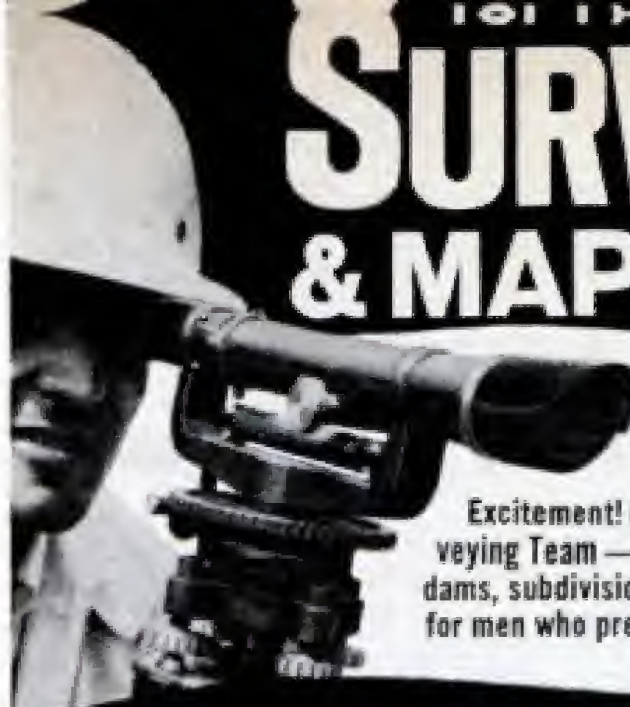
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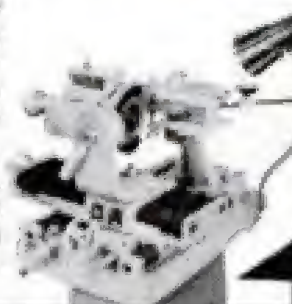
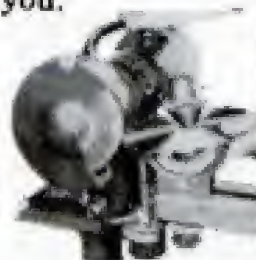
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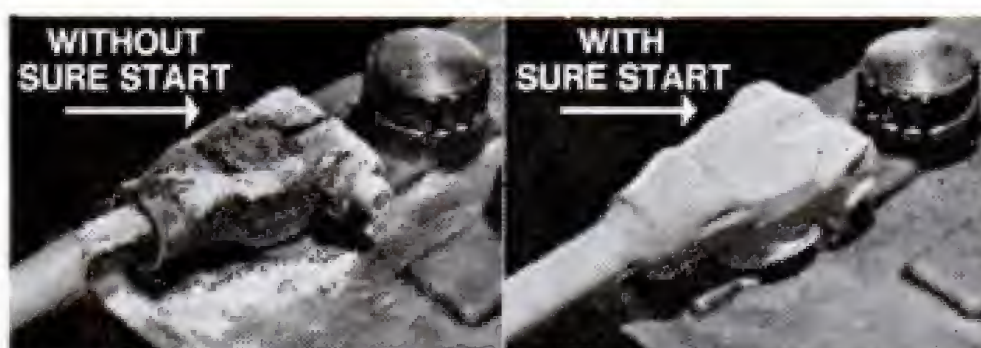
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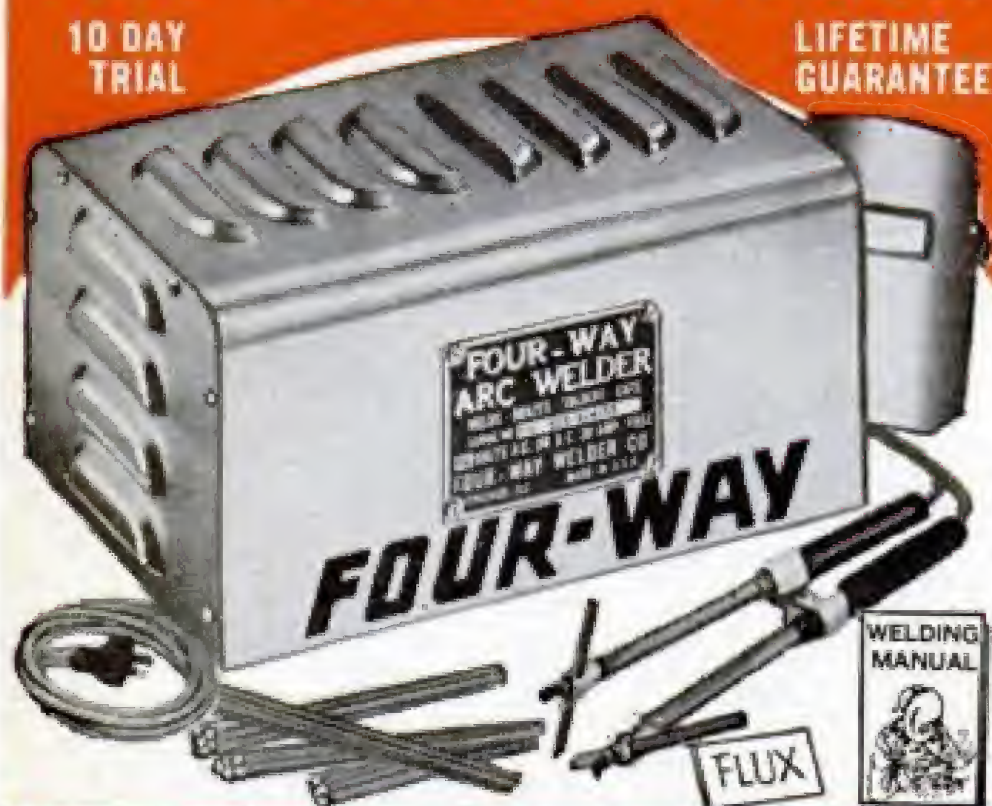


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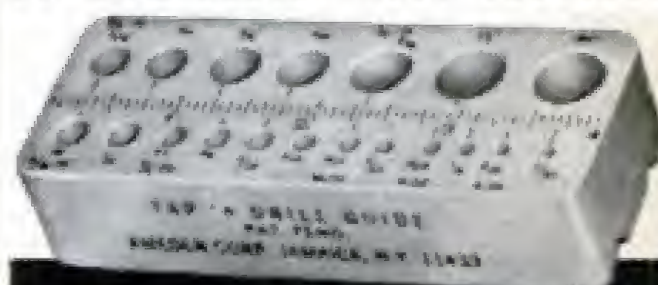
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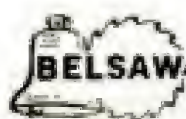
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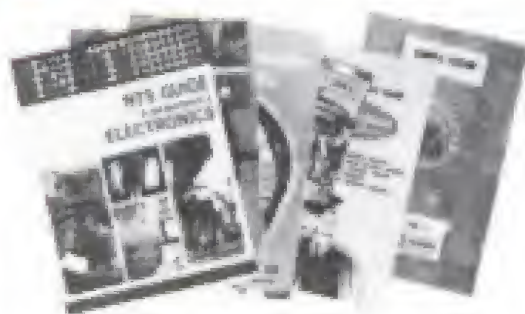
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# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Crack patch

*My patio floor is of natural stone laid in a concrete bed. Only 10x12 ft., it's cracked diagonally all the way across, right through the stones. The crack is a hair-line part of the way and not more than 1/4 in. at the widest. Do I fill it as is, chisel it wider or what?—C.E., N.J.*

By "laid in a concrete bed," I assume you mean the stones were originally bedded in concrete over a gravel fill, and that the openings between the stones were concrete-mortared flush with the surface. Settling of whatever the builder used as fill has undoubtedly caused the crack. There's a possibility that the crack may open farther, but I'd try filling it "as is." Several types of concrete crack fillers are available, some of which come in a cartridge for use in a caulking gun. The main problem is to clean the crack thoroughly, removing all dirt and loose debris. Usually you can do this with a strong stream of water from a hose while using a small screwdriver or other pointed tool to loosen any embedded dirt. Thoroughness of the cleaning will determine the success of the repair patch.

A thin mix of concrete patcher will probably run deeper into the fine crack than most other patchers. Fill the crack a little over flush and then brush off lightly. Cover it with wet sacks or cloths and keep them damp for at least 36 hours.

## Lumpy lawn

*Why is my lawn so rough and bumpy under trees? I have a wide curb shaded by large trees and under these the lawn surface is so rough it is difficult to hang onto my power-mower handle. Is there any way it can be made smoother?—I.H., Ill.*

If you look closely during a heavy rain you will see water falling in streams from the tree limbs. This forces the soil into alternate depressions and hummocks that make mowing unpleasant, if not difficult. There isn't much you can do except to spread a thin dressing of black soil over the surface each season and then rake and roll it smooth. When spreading the dressing care must be taken not to cover the crowns of the grass plants. Also, be very careful when raking the dressing not to

damage the plants or pull them loose. If the black soil is damp when spread and raked, let it dry sufficiently to prevent it from sticking to the roller. On sloping curbs or lawns it is often best to use a light top dressing of peat moss, cocoa-bean hulls or some similar lawn dressing rather than black soil which may wash away in a heavy rain.

Any of these dressings will help to "cushion" the bumps and depressions and make your mower more tractable. Of course, it may be possible to trim the trees in such a way as to break and disperse the streams that are causing the trouble, but this may be costly and difficult to carry out effectively.

## New finish 'blooms'

*After I refinished a chest of drawers with stain, an undercoat of sealer and a top coat of brushing lacquer, the lacquer turned grayish-white. I removed the finish, did the job over and again discovered this grayish color. The materials I used were all new, right off the store shelves. Did I do something wrong?—D.T., Ga.*

I suspect you did do something wrong—such as refinishing the chest in your basement where it was nice and cool and the humidity was very high. Or, you may have taken the chest outside and completed the refinishing in the shade when the humidity was also very high. Under these conditions, new finishings sometimes turn grayish-white. This is known as "blooming" and, although not common, it may happen under these conditions, especially with shellac and lacquer.

In your case there is no practical corrective measure except to start all over again. Make sure you get *all* the old finish off, right down to the bare wood. Sand the surfaces and begin—and finish—the job in a well-ventilated room or do it outside when the humidity is low and natural drying conditions are at their very best.

## Hide-a-fence planting

*What plants can I use to conceal a chain-link fence? The fence is about 50 ft. long and, although quite new, I'd like to conceal it entirely.—J.L., Mich.*

If the fence is located where the sun shines most of the day, a flowering vine such as clematis or climbing honeysuckle will do it in a season or two. However, you should consider that it also will contribute to the deterioration of the fence by opening the way to rust. Also, the weight of the vine eventually may cause the linkage to sag between posts. ★ ★ ★



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# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Freeze-up

*What can be done to stop the remote control side-view mirror of my 1965 Pontiac from binding, especially during cold weather?—Jack Rayburn, Memphis.*

The problem begins when water enters the plastic sleeve around the cable and freezes when the temperature drops. To correct it, after the ice thaws, remove the mirror and cable enough to insert the nozzle of an air hose into the sleeve. Blow the water out. To stop water from getting back in, seal the upper end of the sleeve with a windshield sealer compound.

## Wacky wipers

*My 1967 Ford LTD has intermittent windshield-wiper action. The blades work awhile—rest awhile—work again—rest again, making driving in the rain a problem, to say the least. Ford has replaced the wiper motor and switch, and now says there's nothing more it can do. Have you any idea why these wipers are acting so fatigued?—Virgil Redlin, Jasper, Mich.*

Possibly, but I have to give credit to a Ford serviceman buddy of mine who had a similar problem with a car. It took him five hours of troubleshooting to find the cause. In this setup, female connectors mate with male connectors on the back end of the windshield wiper switch. If your problem is like my friend's, one or more of these wire terminals are damaged and making only intermittent contact with the switch. I suggest you make this possibility known at your Ford shop, and let a troubleshooter take a long, hard look at this.

## Clutching clutch

*Why should the standard transmission of my 1964 Dodge 330 be hard to handle? When I first start the engine, it's tough to shift into neutral. Once I force it in, there's no problem thereafter. The transmission's been apart and everything looks okay.—Wally Hardin, Richmond, Va.*

More than likely, the shifting linkage is slipping, worn or misadjusted. Check the linkage at the transmission and also at the lower base of the steering column. That should do it.

## Persistent overheating

*All attempts to solve an overheating problem with my 1963 Renault Dauphine have failed. Hoses, water pump, radiator cap and thermostat have been replaced. The radiator core has been rodded and cleaned, as have the block and head water passages. By use of partition boards at the front end of the side louvers, I've diverted as much air as possible through the radiator. What else is there to do?—Terry Roberson, Roxboro, N.C.*

I can think of three possibilities. At times, the face of the radiator on these cars has become covered with an oil slick that restricts cooling. Just a possibility, but I think you'd want to remove the radiator and wash it by hand with kerosene. Other than this, the problem is probably a bad head gasket or cylinder sleeves that have dropped, which results in a loss of compression and restricted circulation in the cooling system.

## Noisy rear

*Here's a cute one. I've always used the recommended grease in the limited slip differential. Suddenly, I began to get noise and my mechanic is suggesting expensive overhaul. Anything I can do before I go into this?—Nathan Peck, New York.*

You don't mention under what conditions the noise started, but if it began after you put new tires on the rear wheels, here lies a possible cause. If the two tires are of different circumference, although marked the same for type and size, you'll get noise. I'd measure them. One man I know who did this found a two-inch difference. Matching tires with the same circumference got rid of his "limited slip rear end noise."

## Sin of omission

*I have a real puzzler for you on my 1967 Chevrolet. The service manual's ignition switch section on page 6-10 says that when testing with a voltmeter I should get a voltage drop of from 12 volts to 5 to 7 volts. If voltage doesn't drop, the ignition switch isn't functioning properly. Sometimes I get the voltage drop—other times*

*(Please turn to page 76)*





Sure, the  
'69 REVELER  
is a beautiful boat

but the deeper  
you look...  
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it looks

**Look at our new hull.** Four inches deeper all along the keel make it faster, softer, dryer. Twin arches channel water to cushion your ride . . . stabilize turns . . . keep spray away from passengers.

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New 16-ft. Reveler is a

FIRST IN DEPENDABILITY  
**Johnson Boat**   
(That means quality in depth)



## AUTOMOBILE CLINIC

(Continued from page 74)

*I don't. Is my switch good or bad?—Marv Lorenz, Los Angeles.*

Your switch may be good because an important detail was omitted in the manual. The voltage drop will take place only if the distributor's breaker points are closed. If the points happen to be open as you're testing, the path through the ignition resistance wire won't be completed and you won't get the drop. I wonder how many ignition switches have been replaced because the points were open?

### Resolving rough idle

*Although he's really been swell about it, my dealer hasn't been able to correct a rough-idle problem with my 1967 Plymouth with 383-cu.-in. engine. Do you think this is an inherent condition?—Mark Forest, Springfield, Mass.*

There's a chance that the camshaft in your car may be at fault. Ask the dealer to perform a shaft base-circle runout test according to the instructions in service bulletin 68-9-8 (8/13/68). The problem has also been recognized as occurring with the 318 and 440-cu.-in. Chrysler engines.

### Buyer beware

*What can the public do to protect itself against new-car dealers who don't care about you once they have your money? We bought a new truck which didn't have a spare tire when delivered. It took the dealer nine months to get us one, and then he billed me \$50 although the price of the spare was included in the original price of the truck. When I refused to pay, the dealer threatened to turn the account over to a credit bureau. I took the problem to the manufacturer's district sales office. Then the dealer got mad and told me that he wouldn't service my truck. He's still after the \$50. I think there's too much of this "public be damned" attitude.—Dean Parmenter, Salmon, Idaho.*

Of course, I haven't heard the dealer's side of the story, Dean, but I do agree there are some dealers who should be tarred and feathered. When you run across a guy like this, my advice is to write a detailed account of what's going on and mail it immediately to the manu-

facturer's director of customer relations. Don't wait for months to slip away. It's been my experience that pressure put on the errant dealer from the top works wonders.

## Service Tips

● **Mark III owners:** If your car overheats after idling for awhile, it's probably because of an inadequate water pump impeller. Pumps designed with larger-diameter impellers are now at dealers as part No. C9VZ—8501-A. Tell your dealer that service bulletin 15 (1/6/69) authorizes replacement.

● **1969 Plymouth Furys, Chryslers or Imperials with 383 or 440-cu.-in. engines and airconditioning** should be checked to see if the liquid line that goes between the air-conditioner's receiver-drier and evaporator is being held to the fender brace by a nylon strap. If it isn't, better do something about it before vibration creates a noise and eventual condenser failure. Secure the line to the fender brace with tape or by fabricating a metal strap. The dealer can do this for you under the provisions of service bulletin 69-24-4 (11/8/68).

● **Rambler** reminds us to check the rear-axle lubricant level. The lube level should be no higher than the bottom edge of the filler opening when the differential is at operating temperature. If higher, it'll run out, of course. However, if you check the rear axle when it's cold, the lubricant should be  $\frac{1}{4}$  inch below the bottom edge of the opening. This is okay. Don't add more lubricant, because an over-fill condition will exist once the part heats up.

● **Corvette owners:** Because of space limitations in the Corvette with 427-cu.-in. engine, power steering and airconditioning, you have to remove the alternator from its mount and tip it to get the fan belt off. All other Corvette belts can be replaced in the usual manner.

● **A loose drive belt** can cause a problem, as you know, but one that's too tight can also lead to complications. Oldsmobile tells us that a number of power-steering pump failures have resulted lately from overtightening of the pump belt. A tight belt will damage the pump bushing and cause oil to leak past the pump seal. That's bad news, so be sure to check your manual for the correct spec before you tighten that belt. ★ ★ ★

---

**GOT A PROBLEM WITH YOUR CAR?** Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.

---





# The Sears Lawn and Garden Tractors for 1969.

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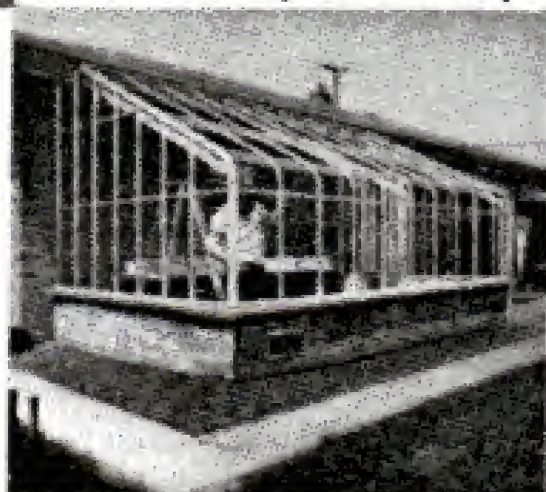
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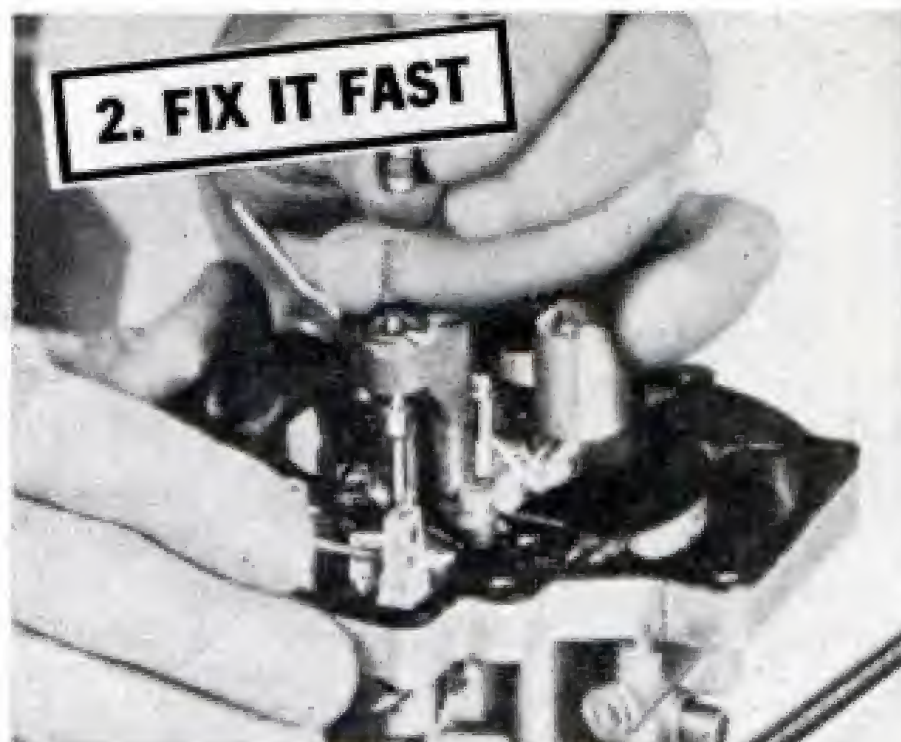
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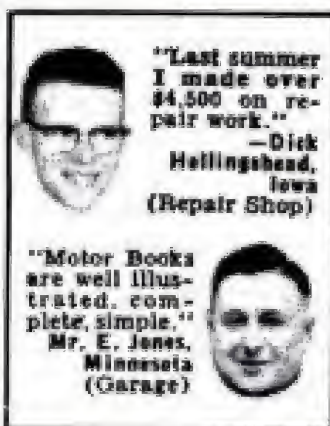


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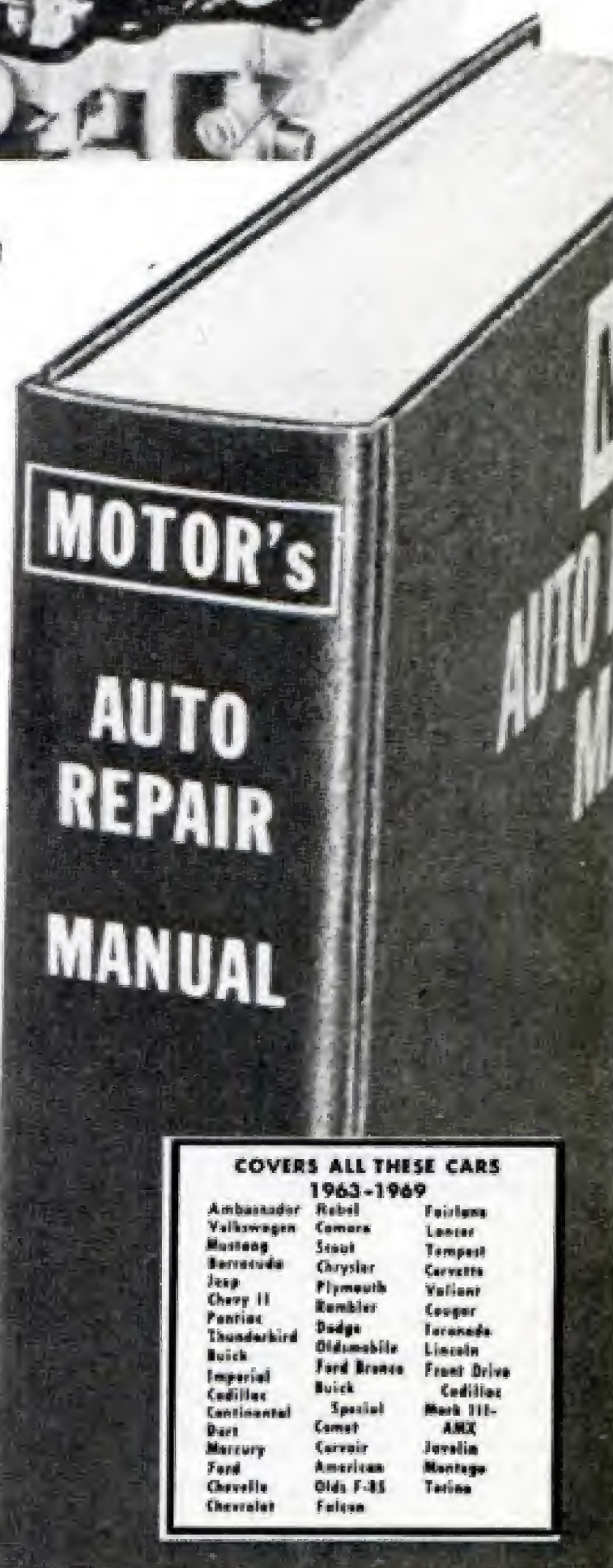
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| Dart        | Corvair     | Montego      |
| Mercury     | American    | Torino       |
| Ford        | Olds F-85   |              |
| Chevelle    | Falcon      |              |
| Chevrolet   |             |              |



ON-THE-GO

# CAMPING

BY WADE MITCHELL

**MASTER CONTROL PANELS THAT MONITOR ALL COACH COMPONENTS** are new and long overdue—and highly desirable for all camping vehicles. One new control panel made by the Elton Corp. is not much larger than a paper plate. It can be mounted where most convenient for the coach owner. Each panel monitors all this information: water-tank level, battery strength, ammeter reading, holding-tank level and polarity indicator and has an a.c./d.c. light indicating which power source is in use, a water-pump indicator light and a battery protector. (Seems like the only thing missing is the LP-gas tank capacity.)

**ESCAPE DOORS AND POP-OUT WINDOWS FINALLY APPEAR.** Kamp-King Coaches, Streamline Travel Trailers, Coachmen Industries and other manufacturers now install new safety doors or pop-out windows as an option. In the event of fire or accidental upset (by wind or collision) passengers merely kick out the door or window and crawl to safety. A metal coach is extremely difficult to break into—or out of. New safety doors should be a great boon to campers and really be of help in emergency situations.

**AIRSTREAM TRAILERS WILL BUILD AND MARKET NEW BRAND COACH.** Airstream, perhaps the most widely recognized brand-name trailer in the world, features aluminum skin stretched over airframe construction. (In dollar volume, Airstream is one of the two largest RV producers in the United States.) Now Airstream plans to build a new factory in the Midwest, as rumor has it, where its new "economy brand" with fiberglass and aluminum construction will be launched. For a company basing its reputation on all-riveted aluminum coaches, this is news.

**DID YOU KNOW THAT** all springs on Ford chassis have been selected by a computer for the last six years? Factors of vehicle weight, tire size, center of gravity and other vital facts are fed into the computer, which "thinks" about the problem and then spits out the correct spring type. The day is fast approaching when virtually all chassis components will be computer-selected. This should make for more rugged and better balanced camping vehicles.

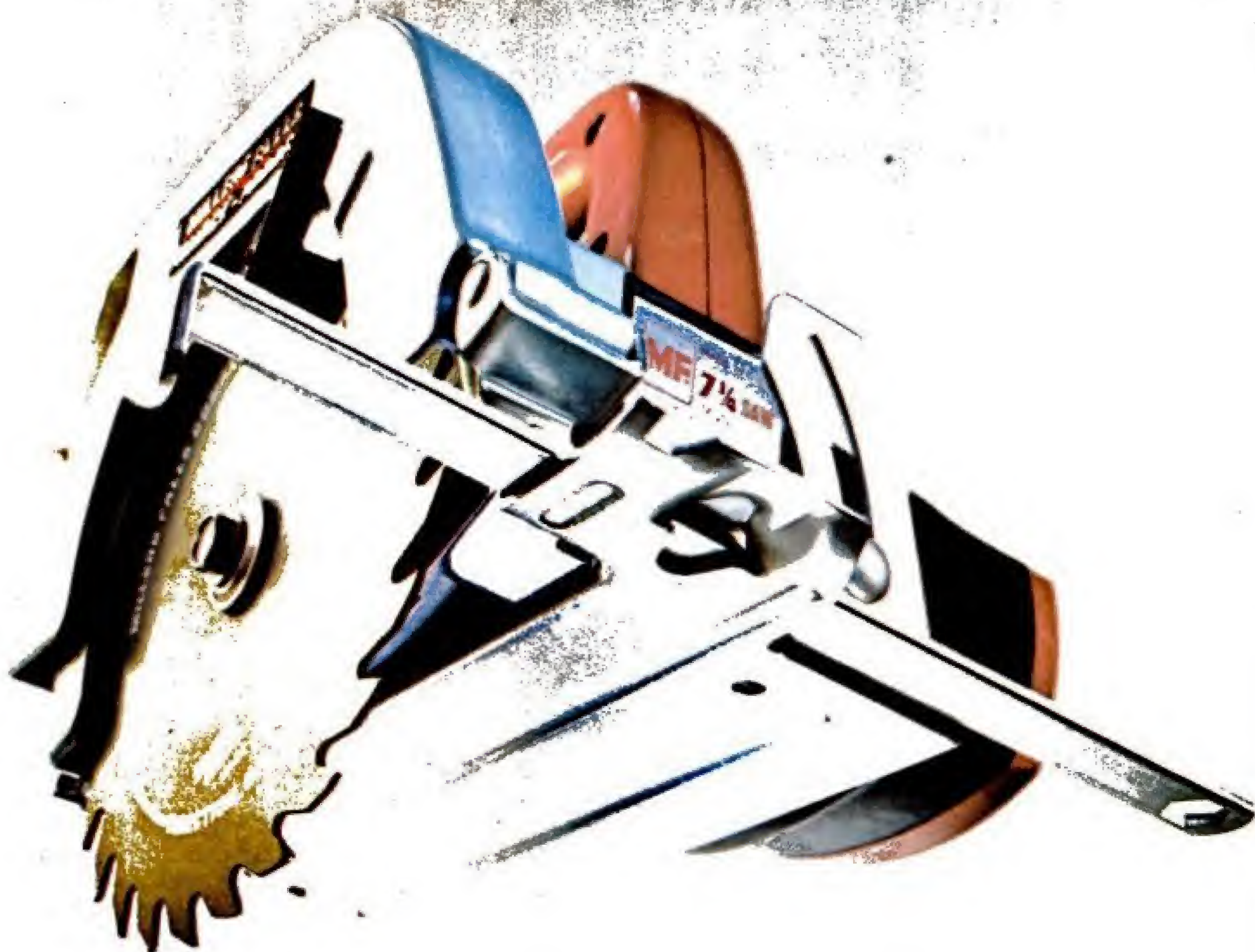
**ALASKAN CAMPERS SWITCH TO ALL-FIBERGLASS EXTERIORS.** In a surprise move, the famed Alaskan telescoping camper coaches are suddenly appearing in all-fiberglass, sleekly contoured, beautifully finished exteriors. According to a company official, the new fiberglass models, featuring vista-type windows along the roof-edge radius, weigh about 100 pounds less per model and will cost about \$200 more per model, over the old aluminum series.

**SPECIAL TRAIL-BIKE COMPARTMENT OFFERED IN NEW TRAILER.** The continued popularity of trail bikes has led one company to provide a rectangular storage compartment at the right rear of the trailer coach, with ramp, for trail-bike or mini-bike storage. The popularity of these off-the-trail bikes is spreading like wildfire.

**WATCH OUT FOR SOFT, SQUEAKY FLOORS!** At the largest recreational vehicle show this spring, I inspected many new, beautifully designed coach models that appeared to be of high quality, with one notable exception: *The floors squeaked.* Whenever a coach floor feels spongy underfoot, or whenever it squeaks and groans as passengers walk across it, you can immediately suspect insufficient bracing and low-cost construction.

★ ★ ★





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New design features that make changing blades easier than you thought possible.

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The strongest guarantee in the game.

That's a lot of ripper for a little jack.

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# It Separates The Ranchers From The Cowboys

New from International is a fancy 4x4 that'll make 'em flip on Saturday night in San Jose—and dust 'em on back-country trails.

By JIM LISTON, Executive Editor

**A** VEHICLE for four-wheel-drive competition and other rugged outdoor driving assignments where power and performance are required," is the way International pegs its new line of 4x4 Scout "recreational vehicles."

"Scout's honor?" we asked. "Then what's this cute confection that looks like a custom job for the Bahamian police?"

At International's Fort Wayne plant, I was eyeing a Scout topped with a chrome luggage rack with bars that extended down the rear to the tailgate.

"That's a deluxe Scout we'll call the Aristocrat. Goes into limited production in April; we'll make only 2500. This is



the hand-made prototype, the only one we have. But, please, you wouldn't . . ."

"I would. Which way to the test track?"

The Aristocrat is a Scout 800A and as such can be powered with the new 304-cu.-in. V8 that develops 193 hp, or with a new Six or a Four. There's a new three-speed automatic (called the T-39) that can be shifted automatically or manually.

Unlike other Scouts, the Aristocrat will be available only with all-wheel drive. The package that makes it aristocratic includes: dark blue metallic hood and top with silver metallic body; travel top with sliding windows; chrome bumpers; chrome luggage rack with "grab bars" to the lift gate; low-profile, glass-belted tires on 7x15-inch chrome rims (for the mag wheel look); color-matched head liner, seats, carpeting, wheelwell seat pads and armrests; and dual outside rear-views.

This was just a preview of a prototype (equipped with a three-speed stick shift) so I scared but spared the engineers, who needed their baby for further work, by taking an easy spin. In second she climbed to 45 at 4000 rpm without a whimper. In the big gear she jumped from 50 to 70 to prove she could pass. In panic stops her 4200 pounds braked with authority.

Wide ovals make the Aristocrat a smooth-riding road vehicle, but how about back-trail mud? A turn to the right locks the front hubs for all-wheel drive. Then set the single-lever control on the transfer box and do the usual with your automatic or stick shift. Traveling on all four, the Aristocrat sloshed out of water-filled ditches that would be better taken with cleats or knobbies. But the 4x4 off-road capability was there—reassuring when you're towing a trailer.

The Aristocrat will separate the well-heeled rancher from the cowhand—at about \$3800 for the 4-cylinder stick shift. He can fringe his survey to \$5000. ★★★



INSIDE AND OUTSIDE of International's Aristocrat







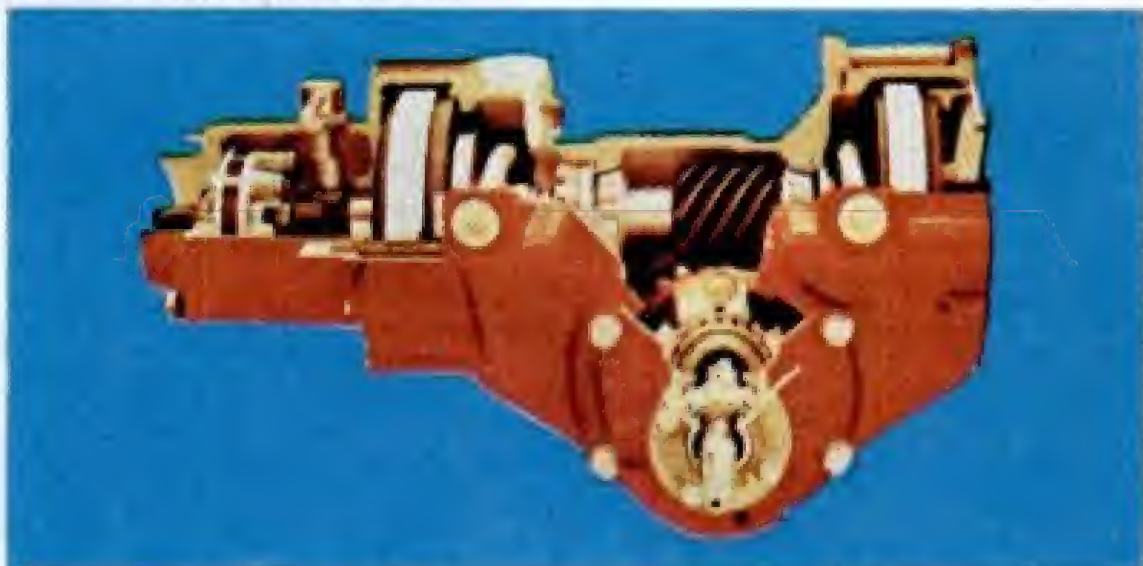
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## Britain's Concorde

Shown at its roll-out at Bristol is Britain's Concorde, sister of the French-built supersonic transport that flew for the first time early this year. (See *You, Too, Can Break the Sound Barrier*, page 111, March '68 PM.) Russia's SST flew on Dec. 31.

## Look out below!

Spectacular air-to-air photo (left) shows British naval aircraft in a simulated attack. Planes, from Squadrons 809 and 892, are Sea Vixens (twin boom) and Buccaneer WKII.

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**He used Autolite plugs. Like you buy.**



This Ford-powered Lotus is the 1968 World Champion of Formula 1 Grand Prix racing.

It had to beat names like Ferrari, BRM, and Honda.

Never did spark plugs have to perform in a more competitive situation. What kind were they? They were Autolite plugs. Like the ones you can buy for your car.

Autolite spark plugs can stand up to the pressure of competition. They have a special zero leakage design that will prevent compression loss

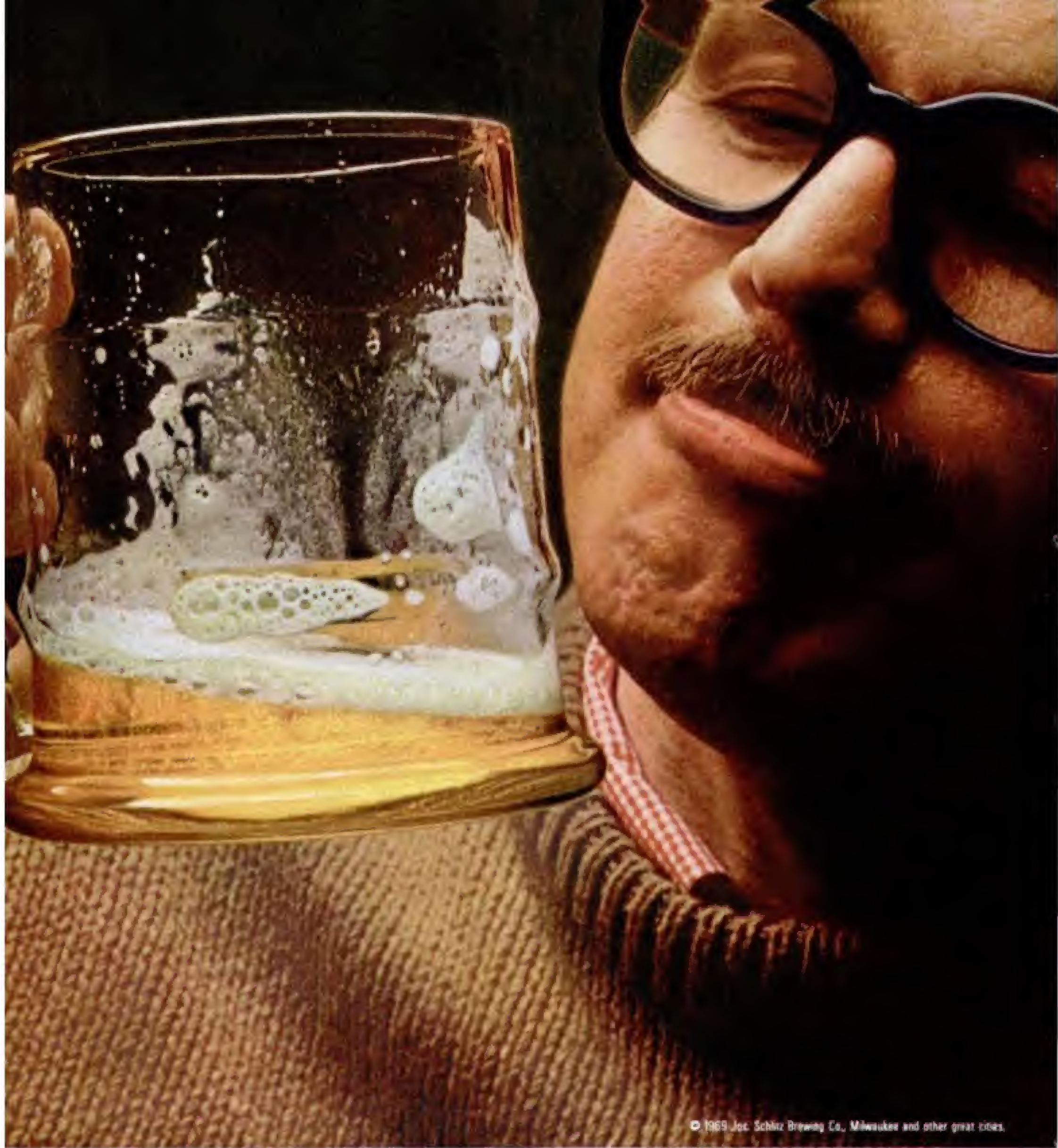
under all operating conditions.

Why Autolite plugs in a World Championship car? Because there are no finer. Use them in your car. They're built to go the distance.

**Autolite** 







© 1969 Joe Schlitz Brewing Co., Milwaukee and other great cities.

# Taste the golden age of Schlitz

120 years ago, it took Joseph Schlitz months to brew and age his golden mellow beer. It still takes us months. The golden age is what makes Schlitz America's choicest premium beer.



**“When you're out of Schlitz, you're out of beer.”**

Milwaukee Journal-Sentinel and other newspapers



# ***How You Look to a Truck Driver***

By E. D. FALES JR.

Photos by Paul Lemmons

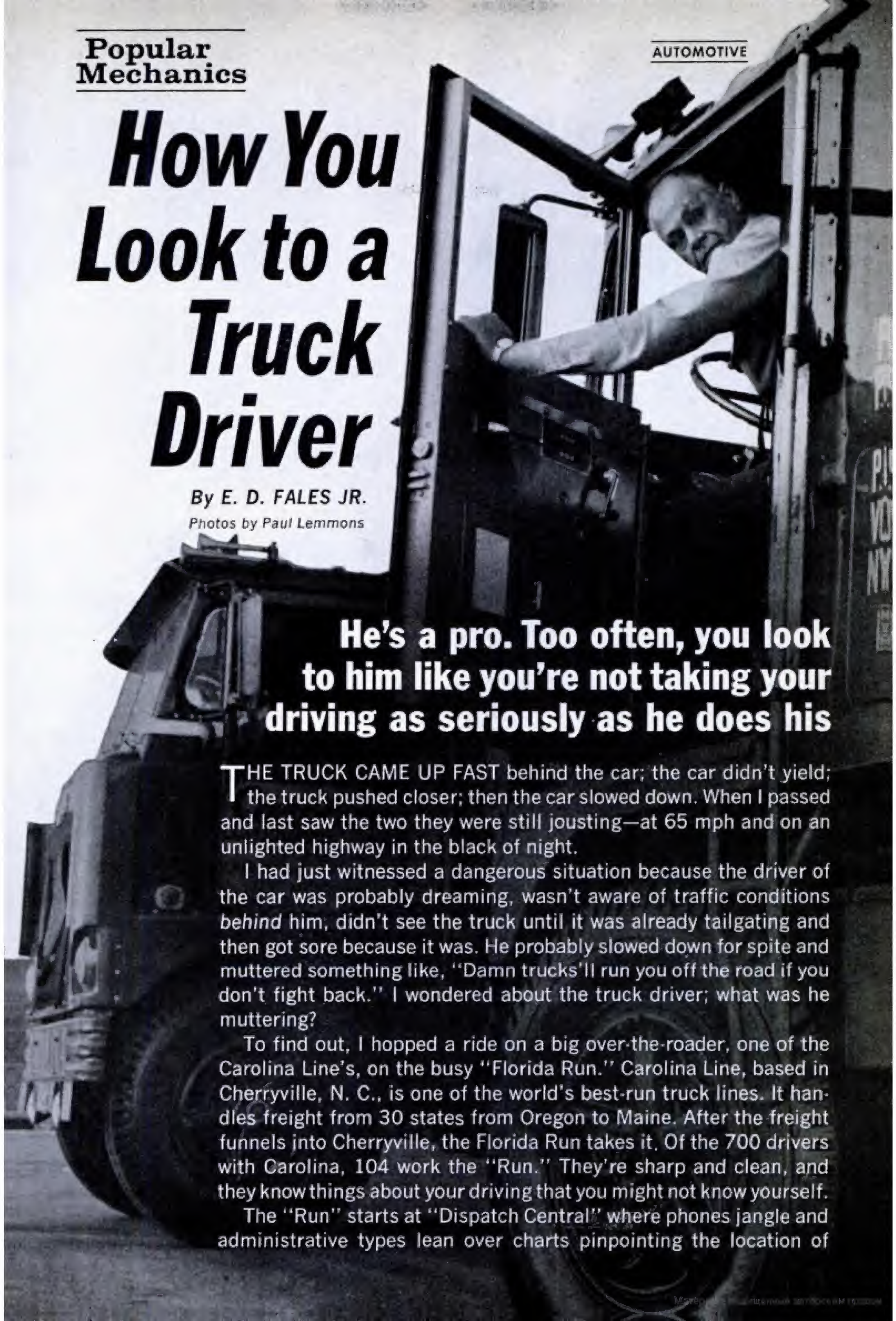
**He's a pro. Too often, you look to him like you're not taking your driving as seriously as he does his**

**T**HE TRUCK CAME UP FAST behind the car; the car didn't yield; the truck pushed closer; then the car slowed down. When I passed and last saw the two they were still jousting—at 65 mph and on an unlighted highway in the black of night.

I had just witnessed a dangerous situation because the driver of the car was probably dreaming, wasn't aware of traffic conditions behind him, didn't see the truck until it was already tailgating and then got sore because it was. He probably slowed down for spite and muttered something like, "Damn trucks'll run you off the road if you don't fight back." I wondered about the truck driver; what was he muttering?

To find out, I hopped a ride on a big over-the-roader, one of the Carolina Line's, on the busy "Florida Run." Carolina Line, based in Cherryville, N. C., is one of the world's best-run truck lines. It handles freight from 30 states from Oregon to Maine. After the freight funnels into Cherryville, the Florida Run takes it. Of the 700 drivers with Carolina, 104 work the "Run." They're sharp and clean, and they know things about your driving that you might not know yourself.

The "Run" starts at "Dispatch Central" where phones jangle and administrative types lean over charts pinpointing the location of







**STEP ON IT** if you're passing. Get through turbulence quickly, but don't let truck behind (from which picture was shot) scare you into lane too fast



**LAY BACK FARTHER** on exit ramp even though you're where you belong: If truck decides to make last-minute exit he won't see you; you're in his blind spot



some 2000 of Carolina's rigs. The double-header run of two White twin-screws with 250-hp Cummins diesels that I am to ride gets clearance for Jacksonville, 400 miles south, and I head out in the predawn darkness to where the tractors are warming.

There are six of us in all: two drivers; two copilots; photographer Paul Lemmons, and this reporter. We swing up into the two sleeper cabs. I ride in No. 1914, the lead, with driver Yates Webb and copilot Hillard Wise. We're towing a 45-foot box full of Vermont gravestones and assorted tools. Right behind us throbs No. 1916 with a rag-top trailer and, I suppose, more gravestones.

Webb beeps the horn and bangs the lever into low. No. 1914 bucks, takes hold, creeps. And right off I get lesson No. 1. Just as we start out the gate we see headlights coming slow on NC 150. When the driver sees us he suddenly remembers that he's in a hurry and speeds up just enough to block us. We come to a shuddering halt. Webb has to get started all over again.

"Now watch," says Webb. The guy who was in such a hurry to beat us goes two blocks and turns down a side street.

"They'll do it every time," Webb grins. "On the trucks we've got a saying: The guy who's in an awful hurry isn't going very

**YOU'RE GETTING PUSHED** probably for good reason. Don't dawdle, else pull over to let truck pass. Downhill, truck has to build up speed for the next hill

Too close —  
Increase  
distance

Safe distance —  
Keep up  
your speed

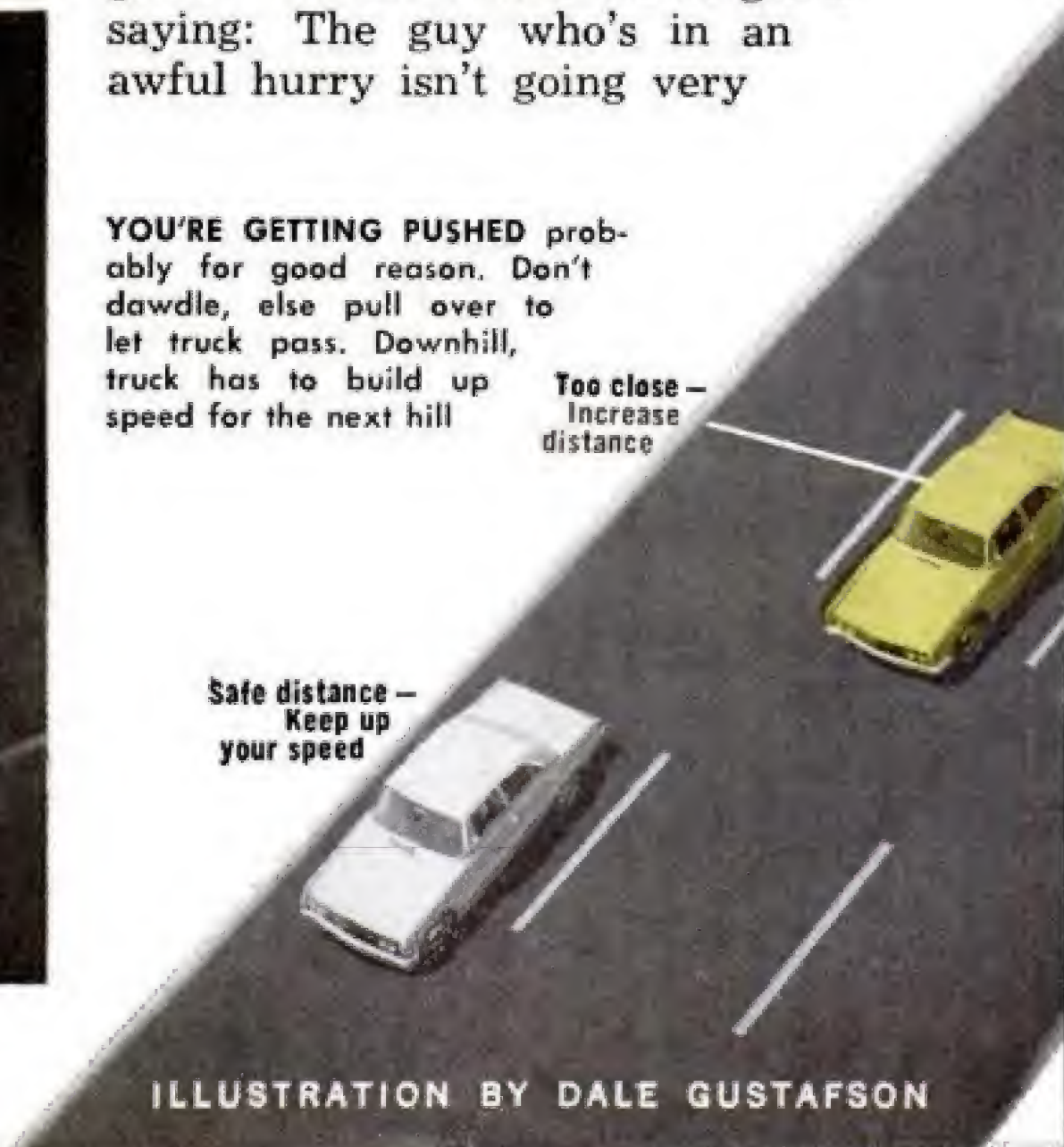


ILLUSTRATION BY DALE GUSTAFSON



far. You'll see." Webb, a big, quiet man, looks like an airline pilot in his gray uniform. "It helps," he says. "Other people respect a uniform."

He works this big twin-screw ship (four of its six are driving wheels) up through five gears, 1 to 5. In my big side mirror I see No. 1916, with drivers Crosson Padgett and Jim Davidson, right behind us. Clear of town, Webb lifts the lever to high.

Now he works the same five gears.

"However, this

Don't stay here — Move back or ahead

Trucker may not see you here

Wind-buffeting again — Bad spot

Poison — don't tailgate

Turbulent air flow

Flick lights — Get trucker's eye — He can't hear your horn

Too close — Move right or left

**LOOK OUT** if you find yourself in one of the positions around a truck as indicated in color on drawing at left. Callouts on the ten positions indicate potential danger for each

You're committed — Get on with it

Wind-buffeting area — Pass by quickly

Massed air shock wave

Bad spot — You're riding a shock wave

Keep moving ahead 'til well past truck

time," he says, "they're running 6- 7- 8- 9- 10." It's slow work but now we are doing 45 in 9th. "We're pulling 35 shipments," he says. "Truck's total weight: 68,900."

About 8:00 a.m. we encounter our first hill. The Cummins yammers. Downshift to 7, speed 32. We're holding up a line. Webb takes a creeper lane. But when we get to the end there's still quite a line of cars coming. Rather than pull out in

front of everybody at slow hilltop speed he stops and waits. A dozen grateful drivers clear.

"I've never seen a truck do that," I say. "Do you do it often?"

"About once every trip. People sure appreciate it."

We go charging downgrade—toward a slow car ahead. Webb, who rarely "pushes" a driver, has to brake down. "Drivers don't like it when we come downhill fast, then go up slow," he says. "I don't blame them, but we can't help it sometimes. A heavy truck needs momentum or it'll go up the next grade at 15 mph and block everybody. When you can, always pick up speed on a hill if you see a truck trying to make the grade. You help everybody."

"Sure," I say, "that's fine. But what about the trucks that push you on the Interstates, because they want to go faster than traffic goes?"

Webb goes to 10th. Speed 50. "Let me tell you something," he says. "We're no different from you. Car drivers have trouble with other car drivers. We have trouble with some truck drivers, too."

He explains: "We figure there are four kinds of truck drivers: line driv-





**DOUBLE MIRROR ARRANGEMENT** on right side of Carolina Line tractor minimizes blind spots—standard and convex mirrors give close, distant vision



**PASSING ON THE RIGHT** can get you into big trouble in any case, and especially if you pull back into center lane when fast truck on left starts same move

ers who are well-trained and proud of their records; nonline drivers, some good, some poor; gypsies, who sometimes don't know much about driving, and often run with poor rigs; and, worst of all, goofballs. The goofball is the guy who is trying to stay awake with a stomach full of pills. Sometimes he actually doesn't know where he is. Any guy who deliberately bugs you on an Interstate is apt to be on pills. A goofball is worse than a drunk. Stay away from him."

Every word Webb is saying he's shouting. I shout back. Already I'm hoarse. I'm learning something else: A truck cab is a noisy place.

By 9:00 a.m. we're southbound on fast I-26 in South Carolina. Copilot Hillard Wise sits in the middle. I'm in the right seat. In all the noise I hear a faint sound at my elbow. I look out. A guy is passing on the right whacking his horn. "There's a car down there," I say. "Can you hear him?" "I've been watching him," Webb says.

People think truck drivers can hear horns. Some can, some can't. When passing a truck never rely on your horn. "If you want to be sure a truck knows you're there give him a light flash, and watch his eyes in the mirror."

"Stay away from the right door," Webb shouts. "I can see cars down

there because we use 'diminishing mirror.' But many trucks don't have those." The little round convex mirror brings in close cars the big mirrors can't see.

A good trucker, Webb tells me, has great respect for motorists who vary their speed for conditions. "It's the one-speed driver who causes trouble for us," he says. We shortcut on a small road that doesn't even show on my map. Everybody ahead takes a hill fast—all except a gray Buick. He's dreaming along at 38. For the next half mile we creep: 4th gear. We lose minutes. "He doesn't realize what he's doing to us," Webb says.

We're on a narrow, old road, but a busy one. "How much clearance between your side and the stripe?" I ask. "One foot," Webb says. I glance in the mirror. My wheels are running close to the farm mail boxes, on the edge-stripe itself. It takes a heap of aiming to send these 34 tons down a chute like this between ditch and traffic. Crossroads ahead.

Suddenly our air hisses. Brakes take, release and take. I hump forward. A Mustang lurches out behind a country store and stops with bumper right on the edge stripe. "Damn!" It's the only time I heard Webb lose his cool. He misses the Mustang neatly. "Why do



guys do things like that?" he demands. "Just suppose his brakes hadn't held?"

What monumental skill it takes, I reflect, to run a ship like this day after day with mistakes all around! Webb has never had a crash in 15 years with Carolina.

About noon, Webb mentions the guy tailing us. He moves in tight behind the box and disappears from both mirrors. "That's a bad place to be," Webb says. "The suction back there is so great that a car is unstable. In fact, slow trucks sometimes move in close to hitch 'an air ride' behind more powerful trucks. It actually pulls them along.

"But even worse, you may get clobbered in the side by a guy waiting at a crossroad—like the Mustang we passed. When the truck goes by he shoots out—doesn't see the tailgater—and hits him.

There's a third danger. The truck may suddenly change lanes to miss an object in the road. Then the tailgater finds himself unable to escape to either lane, and he hits the obstruction.

Then a funny thing happens. Nervous Nellie old Merc pulls alongside and stays there for a couple of miles. Suddenly a fast Chevy belts up behind, gets on his tail and scares him out of the way. The Merc jumps like a rabbit, then pulls right in front of our bumper.

"Please, mister!" Webb pleads as if the other guy could hear him. He feathers his brakes. But it isn't a mister. As she pulls ahead we see a little old lady.

"Old folks—young guys, too—do that all the time," Webb says. "Other drivers push them into trouble. If you see a timid driver trying to pass a truck, never rush up and scare him. It isn't fair." Big trucks shove a bow wave of air. On windy days this can be quite violent. A car too close in front rides this air and is in danger. Alongside the cab the wind shoves back powerfully.

"Stay away from the saddle tanks," Webb explains. "A side wave also pulls inward behind the saddle tanks. Cars sometimes get nudged off narrow roads by the bow wave or sucked in against a truck by the side wave. When you get

to the saddle tanks, keep coming strong. Don't lay there for miles, like some do. That's where the inflow is worst."

Our two trucks go glittering toward Georgia. "Poorest driver we see," Webb says, "is the in-and-outer. He's always an amateur. We know because we see him make other mistakes, too. A good driver is steady. Next, there's the blind passer. Half the time he doesn't realize the danger. Up here we can see cars coming around blind curves and over blind hills long before he sees them."

The "good guys" in a truck driver's book, he says, are those who:

- Give an "all-clear" flash of light when the truck driver is trying to pull in ahead.
- Slow down to help him pull in from a tight spot.
- Tuck their tails in quickly when they turn off the highway. Poor drivers

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***'If you see a timid driver trying to pass a truck, never rush up and scare him. It isn't fair.'***

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make slow, lazy turns; risk getting hit.

- Adjust speed to help the truck take hills.
- Take time to say "thanks" when helped—as when a truck takes the shoulder on a slow hill. To thank a truck, Webb says, flash your rear lights, or give your turn signals a right-left-right sequence. If he can see you, wave.

I leave Webb and Hillard Wise for a while and switch back to No. 1916 with Padgett and Davidson. Davidson is driving when a fast tanker whirls toward us. Its driver grins and whirls his fist in a fast windup. Davidson grins back. "That's a 'Go!' signal. He's saying the road is clear, no wrecks, no cops."

Davidson leans forward, doubles his right fist, smacks it hard into his left palm between windshield and wheel. "If a trucker gives you *that* sign, 'look out,' he says. "It means 'wreck ahead!'"

Oncoming lights now bug us. Truck

*(Please turn to page 206)*





METROLINER U.S.

NEW YORK TIMES PHOTO

# Those Fast, New Trains in U.S. and Canada

By ROBERT P. CROSSLEY, Editor

**T**HE BULLET-NOSED YELLOW Streamliner streaked down the long, straight track. When it pulled into Omaha it had averaged 84.45 mph on its 507-mile run from Cheyenne.

The flat-ended shiny Metroliner pulled into New York's Penn Station. It had just averaged 75 mph on its 226-mile trip from Washington.

The former was in October, 1934. The latter was in January, 1969.

That's progress?

A month before the Metroliner's

debut, a self-propelled Turbotrain, starting daily runs between Montreal and Toronto, had done a little better. It averaged 84 mph for 325 miles—when on time. But it was late so often that the Canadian National withdrew it from service to work the bugs out of it.

I rode on the inaugural run of both new trains. I wanted to compare them with Japan's phenomenally successful New Tokaido Line, on which I had traveled a little more than a year ago (see *The Train That Gives the Jets*

## COMPARISON OF HIGH-SPEED TRAINS

|                               | Metroliner<br>U.S.                             | Turbotrain<br>Canada         | NTL<br>Japan                           |
|-------------------------------|--|------------------------------|--|
| Top Speed in Trials.....      | 160  | 170                          | 160                                    |
| Top Speed on Run.....         | 110  | 95                           | 132                                    |
| Average Speed on Run.....     | 75   | 84                           | 102                                    |
| (Including Stops)             |  |                              |  |
| Distance of Run.....          | 226 miles                                      | 335 miles                    | 320 miles                              |
| Time of Run.....              | 2 hrs. 59 min.                                 | 3 hrs. 59 min.               | 3 hrs. 10 min.                         |
| Power Source.....             | Overhead electric                              | Turbines                     | Overhead electric                      |
| Motors.....                   | 24   | 4 ST6 gas<br>turbines        | 48                                     |
| Power Output.....             | 15,360 hp<br>(640 per axle)                    | 1600 hp<br>(4 x 400)         | 8880 KW<br>(185 per axle)              |
| Controls.....                 | Manual with speed con-<br>trol set by engineer | Manual by<br>engineer (dual) | Automatic braking<br>and speed control |
| Number of Trains per Day..... | 2  | 2                            | 66                                     |
| (one-way)                     |  |                              |  |
| Number of Cars per Train..... | 6  | 7                            | 12                                     |
| Capacity of Train.....        | 308  | 300                          | 1000                                   |





**TURBOTRAIN  
CANADA**



**NTL JAPAN**

BRUCE MOSS PHOTO

## ...They'd Never Make it in Japan!

*the Jitters*, page 94, April '68 PM).

A newspaper story described the Metroliner as "almost as fast as the NTL," and a University of Pennsylvania professor described it "as much the same."

Now I'll tell one.

The NTL, with 66 12-car trains a day in each direction and its 102-mph average over the 320-mile Tokyo-Osaka route, is the pride of Japan.

I can't see either the Metroliner or the Turbo, when a three-car version

finally starts running as a shuttle between New York and Boston, ever becoming the pride of the U.S.A.

True, we have other things to be proud of—Apollo spacecraft, for example, and tremendous airplanes like the C5-A. But even Robert A. Nelson, director of the Transportation Department's Office of High-Speed Ground Transportation, admits the Metro is "not high-speed transportation."

Despite all the brave talk by the Penn

*(Please turn to page 205)*

**PRETTY STEWARDESS** serves lunch airline-style in "Turboclub." Seconds later, wine bottle tipped over



**UNLIKE JAPANESE TRAIN**, Turbo is controlled entirely by engineer. You can watch track over his shoulder







## Garage goes to customers

All it takes is a phone call to the dispatcher (upper left), and a completely equipped garage-on-wheels comes to your home or company parking lot to service your car . . . that is, if you live around Guilford, England. The inside of the mobile garage (left) is loaded with equipment, including electronic gear, so the mechanic can do everything from tuneup to oil change to wheel alignment (above).



## New underwater team

A pair of deep-diving Navy research subs, the *Sea Cliff* (left) and the *Turtle* were launched simultaneously by the Electric Boat Div. of General Dynamics. The 21-ton submarines can dive more than a mile deep.



## Chariot for beginners

The Colliday Chariot, designed by Briton R. G. Collier as a commuter and shopper car, can be driven by a novice. Controls consist of a starter switch, steering wheel and two pedals marked "stop" and "go."

POPULAR MECHANICS





## This is a home furnace?

Not much bigger than a two-pound coffee can, this experimental furnace is so efficient it can heat a nine-room house while fitting in a kitchen cupboard. Developed by Raytheon, the bantam boiler burns gas at a super-high combustion rate to heat circulating water.



## 130 mph—on two wheels

Hottest motorcycle import from England is this BSA Rocket 3, said to hit 100 mph in 14 seconds. The three-cylinder bike has a top speed of 130 mph, will sell here for \$1700.

MAY 1969



## Testing an underwater door

Slithering out a small hydraulic hatch, North American Rockwell divers make the first actual undersea test of the lockout system on the Navy's deep research submarine *Beaver*. The system will let divers leave and re-enter the sub in future deep-ocean experiments.



## World's longest 'window'

A continuous ribbon of glass rolls through a new half-mile-long PPG float-glass plant near Meadville, Pa. The glass is floated on molten tin to make it supersmooth.

101



**PM OWNERS REPORT**  
**BUICK LE SABRE**

A Nationwide Survey Based on  
1,150,000 Owner-Driven Miles

# Heavenly Ride, but the Devil to Pay For Fuel!

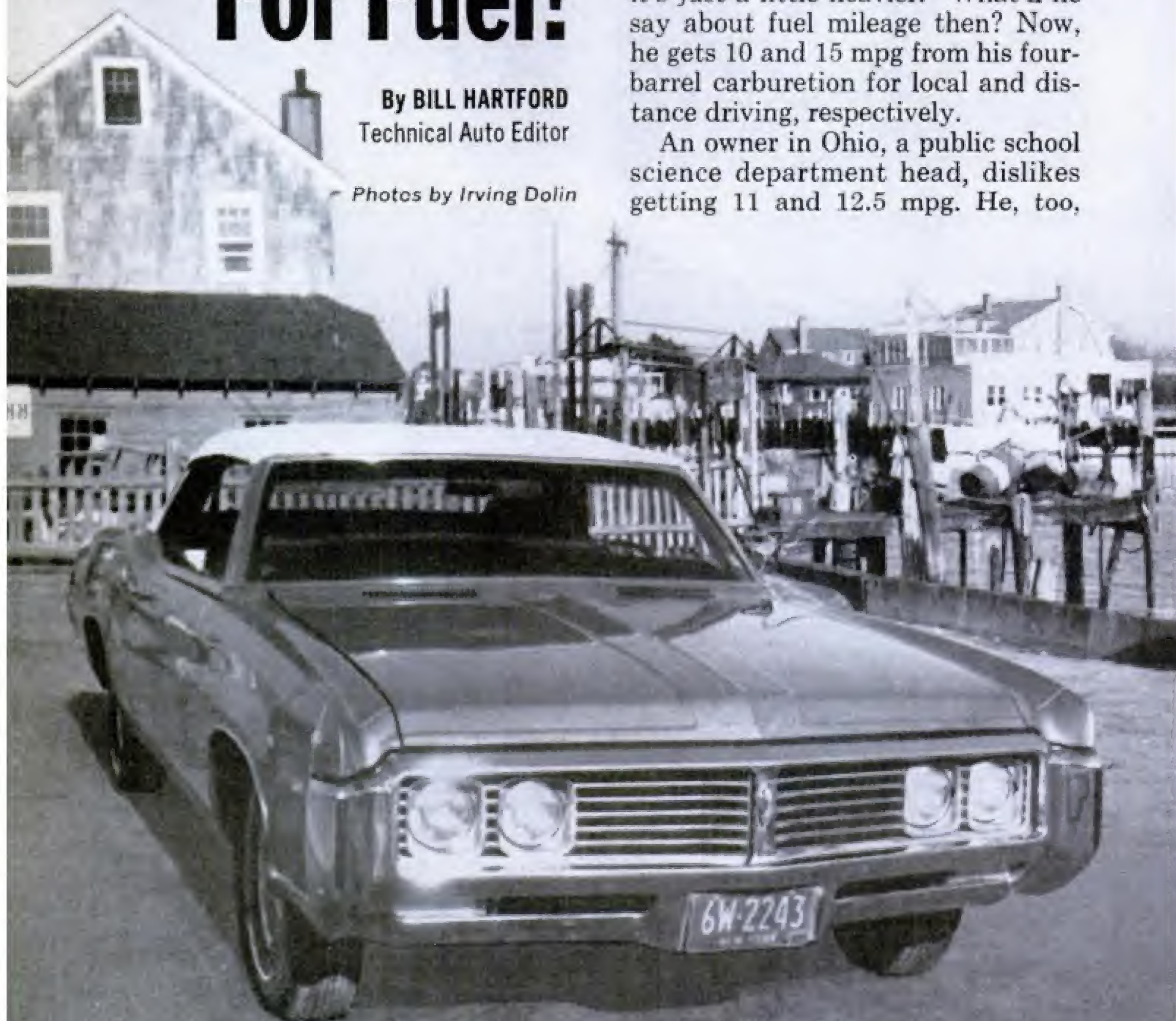
By **BILL HARTFORD**  
Technical Auto Editor

*Photos by Irving Dolin*

**P**UMPING A GALLON of premium petrol through a 350-cu.-in. V8 every 12 miles to push two tons of Buick Le Sabre around town doesn't seem too unreasonable, but owners seem reluctant to accept the price of big car luxury and comfort.

"Poor gas mileage" is the major complaint of a North Carolina real estate salesman, who nevertheless finds "riding comfort" the best attribute of his Le Sabre. For even more comfort and steady ride, presumably, he says, "I hope to go to the Wildcat; it's just a little heavier." What'll he say about fuel mileage then? Now, he gets 10 and 15 mpg from his four-barrel carburetion for local and distance driving, respectively.

An owner in Ohio, a public school science department head, dislikes getting 11 and 12.5 mpg. He, too,







likes "comfort of ride" best, and he, too, "wanted a heavy car."

The Le Sabre weighs in at about 4200 pounds, and in one objective test that might serve as a yardstick of fuel economy, averaged 16.162 mpg. That's the result obtained by the recent Union/Pure Oil Performance Trials (*What Price Power?*, page 120, April PM). The Le Sabre ran in Class III, medium eight-cylinder, two-door sedan or hardtop. Winner in this class, running with a 318-cu.-incher, averaged 18.589 mpg; economy of Le Sabre, packing a 350, was about the same as more similarly powered competitors.

This won't make owners any happier about fuel economy. Nor will it affect their aspirations for a still larger, more luxurious car: A North Carolina salesman wants "a bigger, longer, more expensive looking car." Several owners indicated that the Electra was the car they really wanted, and the one they hoped to swing next time around. The Electra, incidentally, ran in Class I at the Performance Trials and got 14.737 mpg. How's that, folks?

One joy of owning a Buick that lightens the financial burden of operation is that, as an Iowa farm machinery zone manager says, it's "troublefree." It "doesn't dollar me to death," he adds. A retired Illinois man also likes his car's reliability: "Freedom from repairs," he says, "keeps me away from service stations." Indeed, when questioned on mechanical troubles, 71 percent say they've had none—quite a respectable figure considering that 50-50

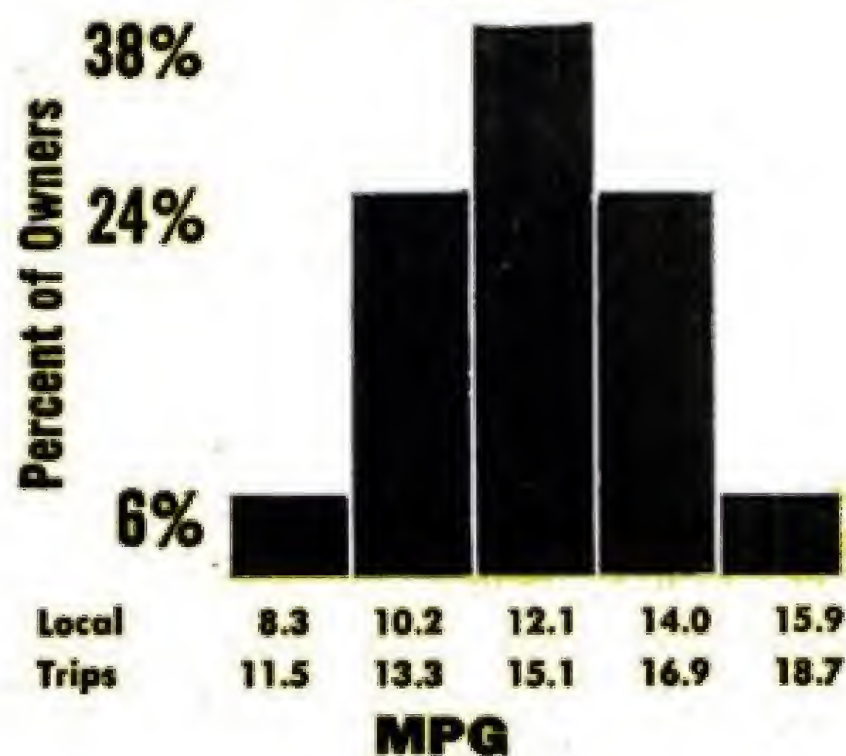
**HANDSOME AND CLEAN** as the car is, owners say first consideration in buying was past experience



**SMOOTH RIDE AND COMFORT** were high on owners' list of likes. Some found that lowered head restraint rubs spinal column; many still find it hard to accept

### LE SABRE FUEL MILEAGE CHART

350-cu.-in. V8



|             | 8.3  | 10.2 | 12.1 | 14.0 | 15.9 |
|-------------|------|------|------|------|------|
| Local Trips | 11.5 | 13.3 | 15.1 | 16.9 | 18.7 |

**MPG**





**CONTROLS ARE CONVENIENT**, but ashtray isn't; design of steering wheel confuses its upright position



**GLOVE BOX** is big enough for one pair of gloves; that's about all, say owners who want bigger one



**REAR VISIBILITY** was one of owners' biggest complaints. It goes for all models, not just the convert



**TRUNK SPACE** is ample for most, but not for few who think it's too small for car of Le Sabre's size

is roughly the yes-no figure we're used to seeing.

If owners are happy about reliability, they're overjoyed about what for them is the Big Three—handling, ride and comfort. A Minnesota farmer gets carried away: "I think it's the most comfortable riding, steering, handling of any car on the road; there's absolutely no road noise." "Quietest car I've owned," confides a New Hampshire maintenance supervisor.

An industrial electrician from Ohio also likes ride and handling and the "solid feel" of his Le Sabre, but does, however, complain about "road and wind noise." Wind noise, specifically, was disturbing to other owners; to as many, in fact, as found fuel economy their biggest bugaboo. "Wind noise around the doors," complains a North Carolina stock broker (who bought a Le Sabre because "the dealer donated \$1000 to the golf tournament which is held at my club"). For other owners, part of the wind-noise problem is due to leaks around the ventless side glass.

"Give us back vent windows!" yells a 1000-mile-a-week Illinois salesman, and "Put the wing windows back in," echoes a Minnesota teacher.

A change in design to include vent windows was mentioned often—second only to the call for improved rear visibility. Across the board (28 percent, two-door coupes; 30.6 percent, four-door hardtops; 40.4 percent, four-door sedans), owners found Le Sabre models difficult to park and maneuver from



**RUBBER BUMPER INSERTS** are universally liked. "It's about time," says one bumper-denting owner

POPULAR MECHANICS





**HANDLING AND RIDE** mean smoothness and ease of control to most owners; roll in corners isn't disturbing

lack of rear visibility. "Can't see rear fenders when backing," says an Illinois engineering consultant.

Aside from a few traumatic experiences like that related by a Minnesota salesman ("an apparent short in the wiring; car caught fire and dash burned out before fire department arrived"), Le Sabre owners' miscellaneous criticisms—good and bad—are not very serious. A Nebraska salesman finds his car "a little hard to start at low temperatures—10 to 20 below zero." A North Dakota manager wants his passengers to be able to see the clock and

adjust the radio (both placed in front of the driver in a cluster of instruments and controls). He says, "The isolated 'control center' is for 707s, not cars!"

Owners are able to criticize rather minor aspects of design and slight inconveniences like ashtray location and size of the glove box, *because* there really is nothing terribly wrong with the car. Their Le Sabre gives them a soothing ride; it provides almost complete isolation from the ripples and ruts out there on the road. It is, says an Ohio barber, for better or worse, "The Modern Car of Today!" ★★★

### Summary of 1969 Buick Le Sabre Owners Reports\*

|  |                                    |                                       |
|--|------------------------------------|---------------------------------------|
| <b>Total miles driven</b> .....1,153,975 | <b>Body style:</b>                 | <b>Is the Le Sabre your only car?</b> |
| <b>Average miles per gallon:</b>         | 2-door coupe .....28.0%            | No .....50.2%                         |
| 350-cu.-in. V8, local driving 12.1       | 4-door hardtop .....30.6           | Yes .....49.8                         |
| long trips ...15.1                       | 4-door sedan .....40.4             |                                       |
| <b>Specific likes:</b>                   | Convertible .....1.0               | <b>Other cars owned:</b>              |
| Handling .....43.1%                      | <b>Transmission:</b>               | Chevrolet .....30.9%                  |
| Ride .....42.4                           | Automatic .....98.7%               | Buick .....25.9                       |
| Comfort .....28.2                        | 3-speed manual .....1.3            | Ford .....13.6                        |
| Style .....25.8                          | <b>Had any mechanical trouble?</b> | Oldsmobile .....5.6                   |
| Performance .....18.9                    | No .....71.0%                      | Dodge .....4.9                        |
| Economy .....13.9                        | Yes .....29.0                      | Volkswagen .....4.3                   |
| Roadability .....6.0                     | <b>What kind of trouble?</b>       | Pontiac .....4.3                      |
| <b>Specific dislikes:</b>                | Transmission .....12.5%            | <b>What options/accessories?</b>      |
| Economy .....10.4%                       | Cold starts .....11.4              | Power steering and power              |
| Wind noise .....10.4                     | Choke .....10.2                    | brakes .....89.1%                     |
| Rear visibility .....9.4                 | Windshield wiper/washer ..8.0      | Airconditioning .....56.8             |
| Workmanship .....5.7                     | Electrical .....6.8                | Radio .....45.6                       |
| No vent windows .....4.7                 | <b>Dealer repair satisfactory?</b> | Tinted glass .....16.7                |
| Finish .....4.4                          | Yes .....75.9%                     | Vinyl top .....15.3                   |
| Rattles .....3.7                         | No .....20.7                       | Remote side-view mirror ...13.6       |
| <b>What changes would you like?</b>      | <b>Why the Le Sabre?</b>           | Rear defroster .....12.9              |
| Rear visibility .....12.0%               | Past experience .....43.0%         | Whitewall tires .....11.9             |
| Vent windows .....10.8                   | Economy .....14.9                  | Power steering .....10.3              |
| Legroom .....8.4                         | Style .....12.7                    | Power antenna .....3.5                |
| Ashtray location .....6.4                | Reputation .....8.5                | Power windows .....2.9                |
| Glove compartment size ...6.4            | Size .....7.3                      |                                       |
| Headroom .....5.6                        | Performance .....6.3               | <b>Age distribution of owners:</b>    |
| Trunk room .....4.8                      |                                    | 15-29 .....9.5%                       |
|  |                                    | 30-49 .....46.0                       |
|  |                                    | 50 plus .....44.5                     |

\*Where applicable percentages may not equal 100 percent due to rounding and/or insufficient sample.





## Alfa Romeo sprouts wing

The wing that's been appearing on racing cars in recent years has been designed into the sleek, new Alfa Romeo P33 Roadster. In addition to stabilizing the car at high speeds (its inclination adjusts automatically), the wing serves as a rollbar.



## Old-timer with a new look and more speed

North American's World War II fighter, the P-51 Mustang, has acquired, among other things, a new engine and longer nose in an updating by Cavalier Aircraft Corp., Sarasota, Fla. The firm hopes to produce 2000 of the craft, principally as tactical fighters for the Air Force. With a Rolls-Royce Dart turboprop engine, top speed of the Mustang 3 is 470 knots.



## Accordion hitch for a trailer

An accordion hitch between a new travel trailer and its tow vehicle enables passengers to get from their station-wagon "bedroom" to trailer living room (right) without going out. A Munich doctor invented the hitch.







## New Japanese STOL seaplane is unusually seaworthy

A new Japanese seaplane, the SS-2 built by Shin Meiwa Industry Co., could revolutionize search and rescue work. It can land and take off in 10-foot waves; with a 28-mph headwind, takeoff distance is only 260 feet. Top speed is 345 mph and range, 3000 miles.



## Navy tests new assault landing craft

An experimental landing craft recently tested by Navy amphibious forces could significantly improve the landing of troops and cargo. The craft, the LCA-X2, can carry 30 tons of cargo or 275 troops over water, up 60° grades or sideways along a 30° grade.



## Flying fire engine loads water at 70 mph

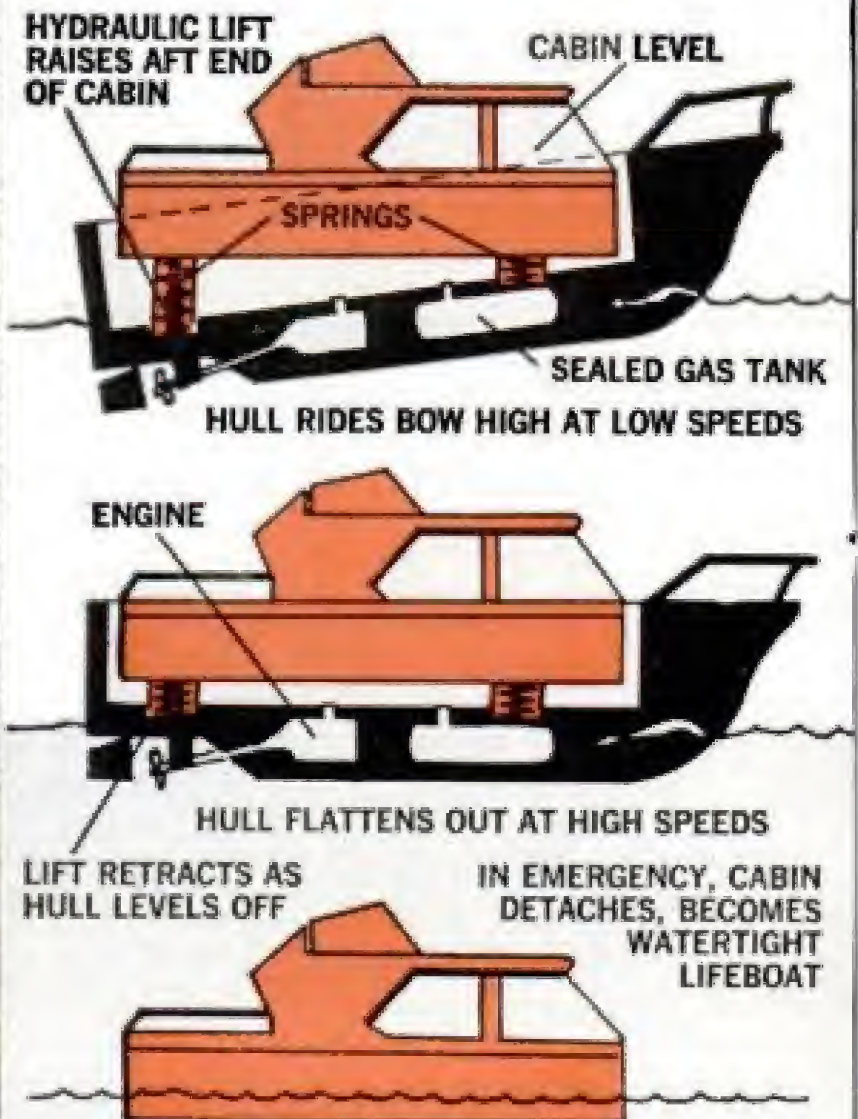
Skimming across water at 70 mph (left), the Canadair CL-215 can scoop up a load of 12,000 pounds of water in 12 seconds and be off immediately to release the load on a forest fire (photo at right shows a water drop). It's the first plane designed for this job.



# Just patented

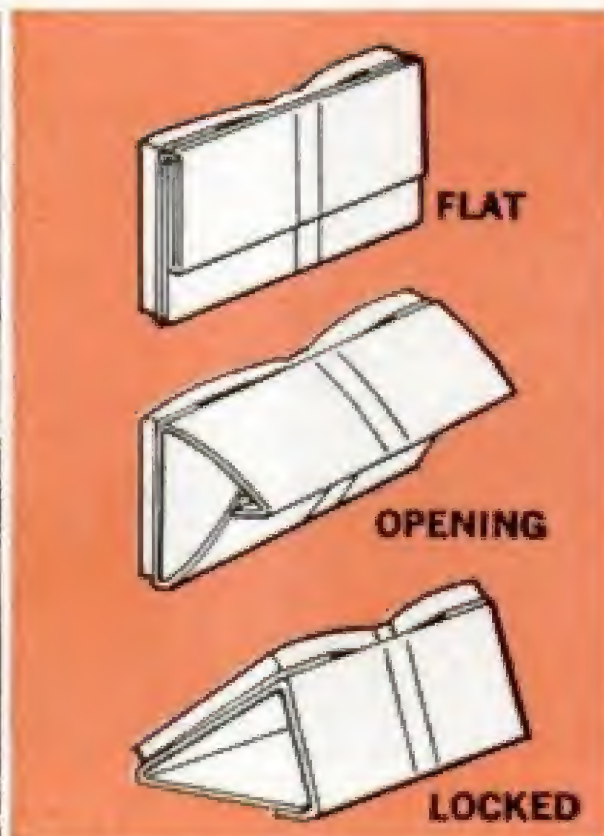
## PM'S PICK OF THE NEW INVENTIONS

Prepared in cooperation with Roger S. Shashoua, Director, International Inventors Assn., Inc.



**1. YOU RIDE ON AN EVEN KEEL** at all times with this clever self-leveling cabin for cruisers. The compartment is a sealed unit completely separate from the hull. Hydraulic jacks raise the after end at low speeds so you can see over the up-tilted

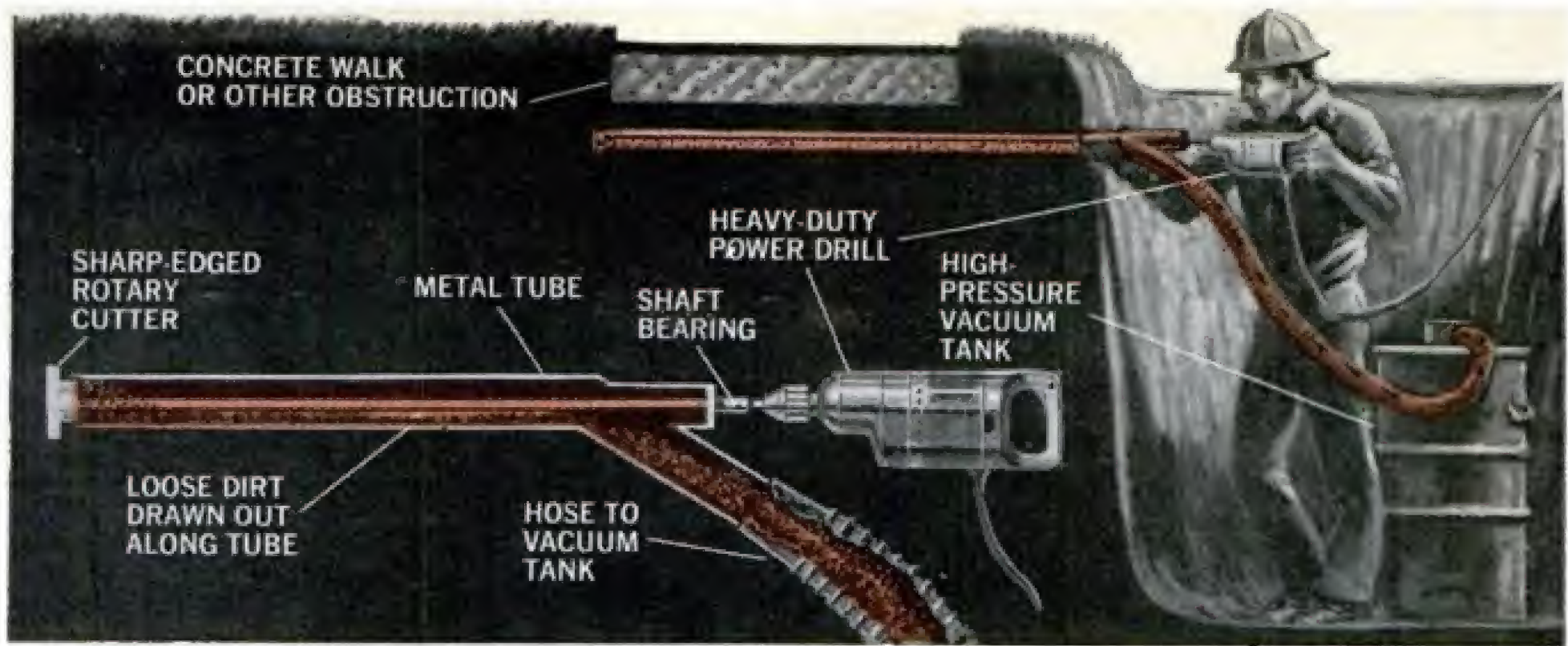
bow. At planing speeds, the jacks retract. When it's rough, springs help to cushion hull shocks. The sealed cabin also lessens the danger of fire and explosion from fumes. In an emergency, it can be detached from the hull and will float by itself



**2. "INSTANT" BOOK STAND** slips over a book's regular cover and folds out to form a sloping rack. Made of a stiff fiberboard, it's handy for reading in bed, studying, following cookbook recipes or checking shop plans. The book's cover slips into a pocket at each side of the rack to hold it in place. Two panels at the back swing out and interlock to make a triangular support. When not in use, the rack can be collapsed flat and left on the book until needed again. Flexible, reinforced seams in the fiberboard allow it to bend with the book's cover without tearing

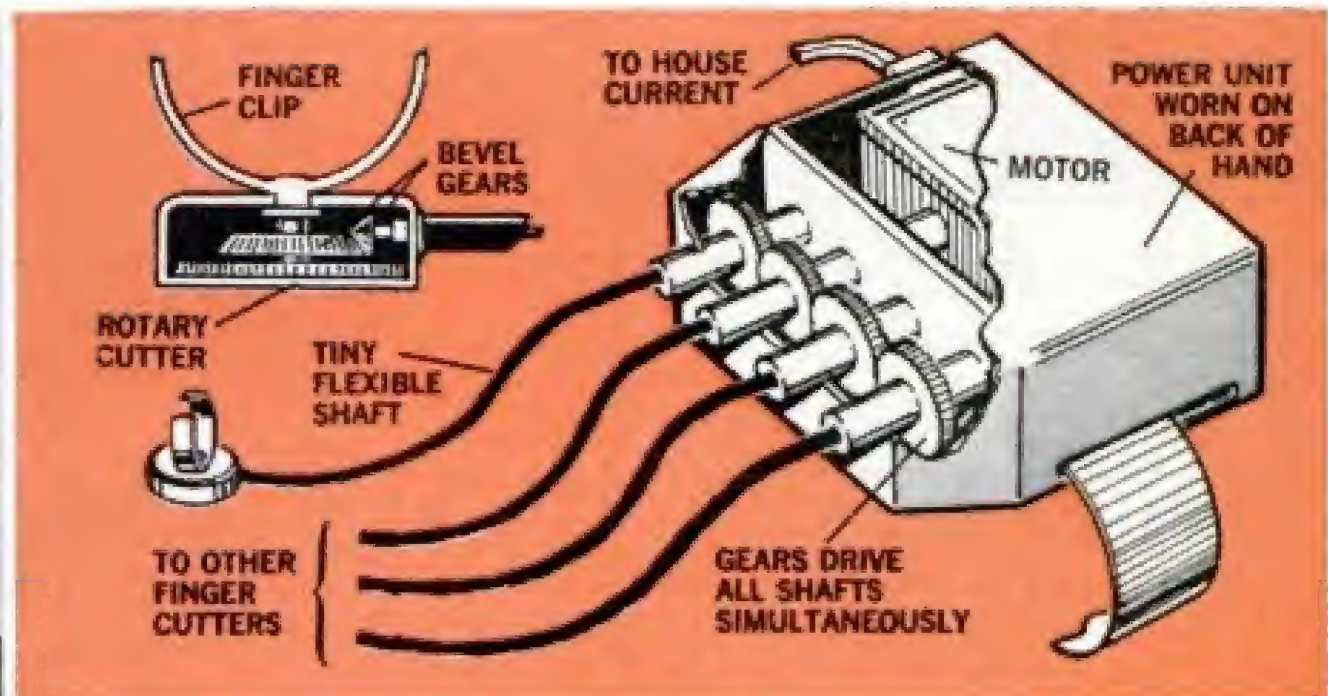
Inventors of the items shown on these pages are as follows: 1. Antonio Cuesta, 2155 S. W. 5th St., Miami, Fla.; 2. Bertram Slanhoff, 1243 Post Rd., Scarsdale, N.Y.; 3. Thomas F. Henebry, Hawleyville Rd., Bethel, Conn.; 4. Frank W. Cooksey, 508 Baker Dr., Birmingham, Ala.; 5. Tentomatic, London. Roger S. Shashoua can be reached at the Inter-





**3. RUNNING PIPES AND ELECTRICAL CONDUIT** under walls, concrete walks and other obstructions is no problem with this vacuum earth drill. Powered by a conventional electric drill, it consists of a rotary cutter at the end of a long metal tube. The

tube's other end is connected by a flexible hose to a high-pressure vacuum tank. As the tube is pushed under an obstruction, the spinning cutter chops away the dirt and the loose debris is drawn into the vacuum tank. This keeps the cutter from jamming



**4. SMOOTHER SHAVES** would be possible with this unusual fingertip electric razor. Four small rotary cutters, one for each finger, are designed to follow the contours of the face and get more easily into hard-to-reach spots. The cutters are driven

by tiny flexible shafts geared together so that they're turned simultaneously by a motor worn on the back of the hand. In its present form, the shaver is powered by house current. For use away from home, a battery version might also be possible

**5. PUT THIS TENT DOWN** instead of up. The ingenious cartop camping rig eliminates the hardest part of setting up a tent—erecting the frame. With the frame mounted on the roof, the car serves as a temporary support. You just drive up to the campsite and attach telescoping legs to the corners of the frame. Then you release the frame from the car and drive out from under it. All that's left to be done is to pull canvas down around the sides and peg it to the ground. The setup time is only three minutes



Pull up and park ...



... spread out the frame ...



... drive out from under ...



... and your tent is all set up .

National Inventors Assn., Inc.,  
680 Fifth Ave., New York, N. Y.  
10019.





## Birdwatcher for science

To observe how birds fly, Prof. Vance Tucker, a biologist at Duke University, puts them in the 30-mph airstream of a wind tunnel and studies the flying—but “motionless”—birds close at hand. By means of a plastic mask on the test subjects, the professor is able to determine how much oxygen they consume, plus the amount of carbon dioxide they breathe out. One finding: Budgerigars use only 1 percent of their weight in the effort of flying.



## Catapult's foxhole

Catapult officers on the new USS *Nimitz* will direct operations from two flush-deck observation stations that raise 18 inches during launches. A station has been built at Lakehurst, N.J., for tests (above).



## It's a riffle sifter

Newly developed by the U.S. Forest Service, the riffle sifter is a machine that travels along the salmon spawning grounds of Western rivers, cleaning the silt from the gravel to increase the production of young salmon.

POPULAR MECHANICS





### Another one from England

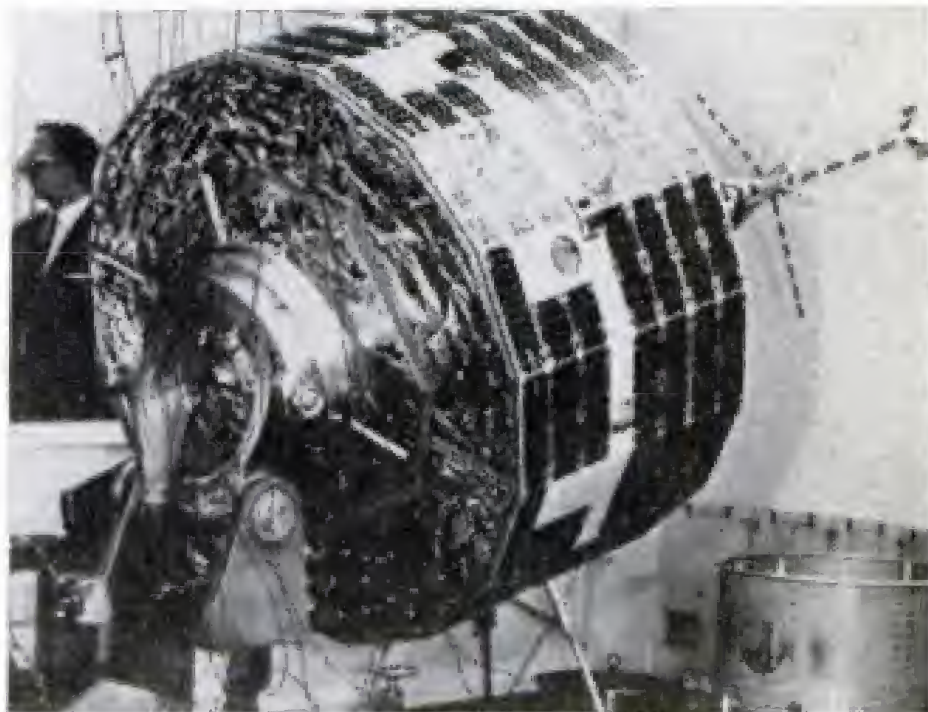
A new British air-cushion vehicle appeared on the Thames recently, undergoing tests by the British Ministry of Technology. The CC-7, a nine-seat vehicle, was built by Britten-Norman Customcraft. The craft may be put to use on river patrol or as a customs launch.

MAY 1969



### On-the-double descent

When Marine Sgt. Frank Spano parachutes into the Vietnam jungle on a reconnaissance mission, he doesn't go alone. A special harness attached to his parachute enables him to take Lobo, his scout dog, along. During the descent, Sgt. Spano lowers the dog away from him on a rope so neither is hurt when they hit the ground.



### First from Germany

The first research satellite built by the Germans is Heos (highly eccentric orbiting satellite), which takes an elliptical orbit around the Earth while measuring interplanetary magnetic fields. The vehicle is shown before launch in the Junkers plant.



# Build This New 4-Place Cabin Plane

Jim Bede's first homebuilt may be the easiest to construct yet. The wings come ready-made, and most of the fuselage just bolts together



By KEVIN V. BROWN

**I**T'S JIM BEDE TIME AGAIN. Almost annually the young Clevelander startles the aviation world with a new—and sometimes wild—creation. This year, it's a do-it-yourself airplane that may be the closest thing yet to an Erector Set homebuilt.

It features a newly designed plastic wing that you can buy almost ready-made, an all-metal fuselage with bolt-together construction (most of the parts already formed), skin that attaches with Pop Rivets and an assortment of all the other necessary parts and supplies that can be purchased from Bede, who says, "I can furnish almost everything but the paint." Complete plans—and they may be the best ever produced for an amateur aircraft—can be purchased from Popular Mechanics for \$30.

In order, Bede's other exotic aviation productions have been:

- A twin-engine business aircraft, with both engines buried in the fuselage behind the cabin pushing one propeller enclosed in a shroud. The buried engines, the ducted prop and boundary-layer-control wing pushed cruising speeds to around 300 mph. Bede built the plane, flew it—made his point—then donated it to the Experimental Aircraft Assn.'s museum in Hales Corners, Wis., and moved on to other things. He now calls it the BD-3, but you needn't pay too much attention to his numbering system.

- Next came the BD-1 (see!), a two-place low-wing monoplane that rocked the aviation world as few have ever done. Reason: Bede's announced price of \$2500 (cover story, Feb. '64 *PM*). He planned to do it with bonded construction (no rivets), interchangeable parts (lower production costs) and



# for \$3500



*Technical Art by Fred Wolff*

honeycomb metal (higher strength-to-weight ratio). He built two, and that was it. Certification problems ran up the cost (and the price), so new money had to be brought in and eventually Jim lost control of the project. The plane was redesigned, certified, and eventually produced as the Yankee and is selling at around \$6500. Even today Jim has mixed emotions about it. "I'm not too mad. They had a lot more money than I could afford. I still own a piece of the business and, if they make money, I'll make money. I'll just use it to try some of my other ideas."

• Meanwhile, back at the Bede drawing board, he dreamed up what must have been the most-minimum homebuilt since the Kitty Hawk Flyer. He called it the Demoiselle, after a French plane of the Wright Brothers' era, and it would have been the closest thing to a



BD-4 with 150-hp engine cruises at 166 mph



Cabin seats up to four persons



Cantilever wing comes ready-made



Wing is removable for trailering



Bolt-together construction eases building



ALUMINUM  
LANDING GEAR  
STRUT

HYDRAULIC  
BRAKE  
ASSEMBLY

RUDDER  
BELLCRANK

RUDDER  
PUSH-PULL TUBE

ELEVATOR  
TUBE SPAR

EMPENNAGE DETAIL

ALL-FLYING TAIL

ELEVATOR MASS BALANCE

METAL WING FLAPS  
(71% SPAN)  
DEFLECTION: 15°, 30°, 45°

AILERON  
DEFLECTION UP 30°

ALUMINUM ANGLES

**BD-4**

TOP VIEW

24' WINGSPAN

FRONT VIEW

6.00-6 TIRE

6.2"  
HEIGHT

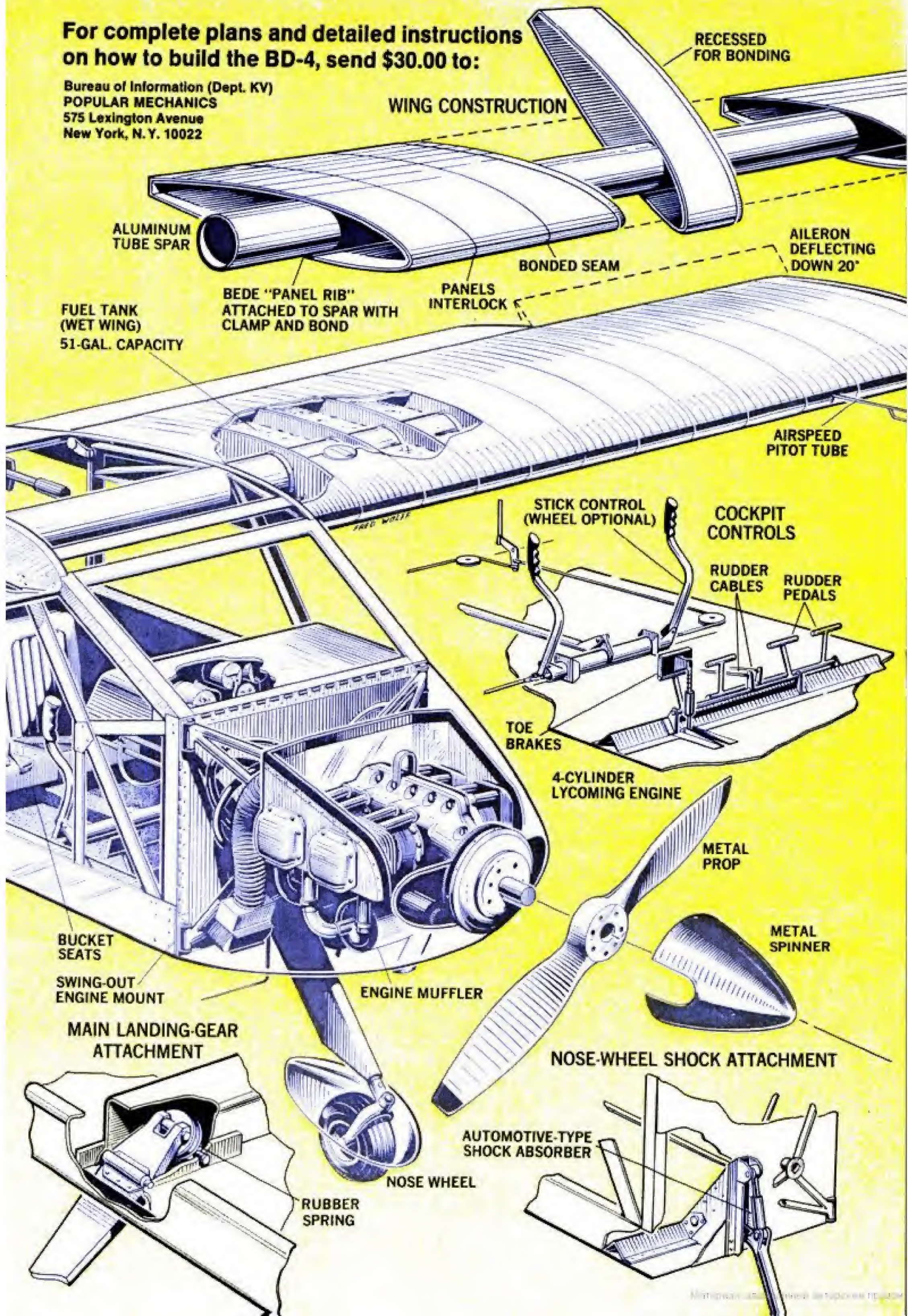
SIDE VIEW

21.6' OVERALL LENGTH



**For complete plans and detailed instructions on how to build the BD-4, send \$30.00 to:**

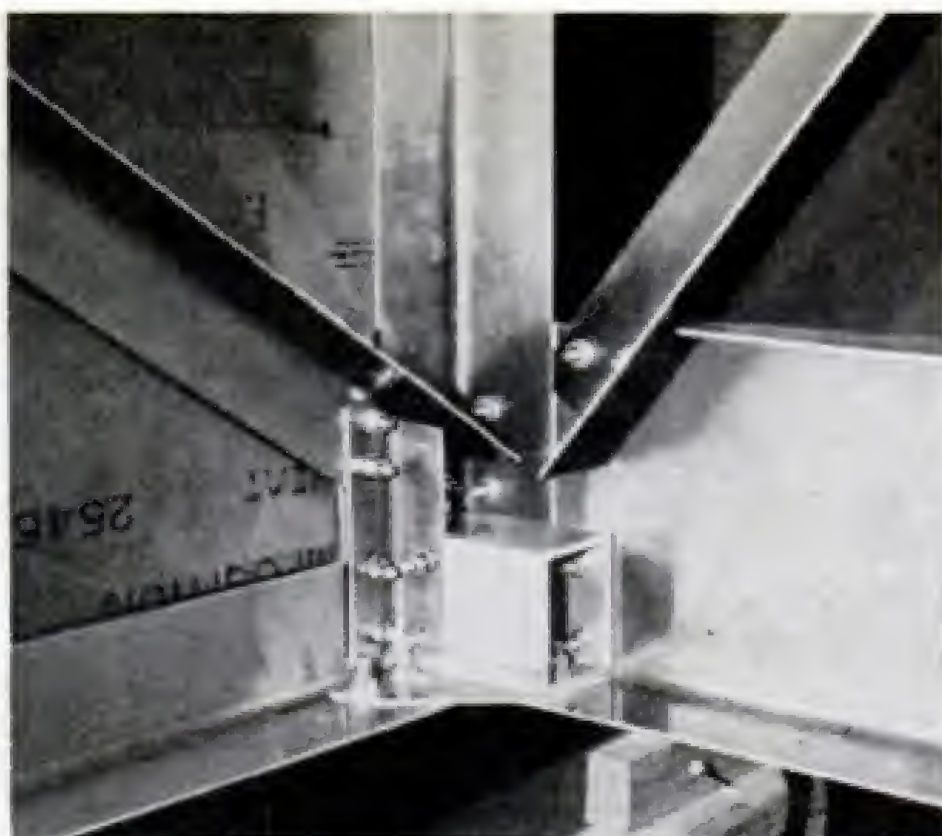
Bureau of Information (Dept. KV)  
POPULAR MECHANICS  
575 Lexington Avenue  
New York, N.Y. 10022







**PAUL GRIFFIN**, project engineer for BD-4, slips plastic wing panels over main spar onto one another



**ALL NECESSARY WELDING** is shown here. Still to do are some forming and drilling, but no machining

flying go-cart. It had an open-air cockpit *and* an open-air fuselage, a framework boom back to the tail section—and the newest Bede innovation, a plastic wing made of small, identical panels fitted together and slipped over the main spar. The spar was an extruded metal beam that first showed up in the BD-1. Bede assembled some of the parts, but the plane never flew.

• Bede's latest project—and the subject of this article—is the BD-4, a high-wing, cabin airplane that you can build at home. It draws on some of his previous projects, but, as usual with Bede, offers some innovations as well.

As mentioned, it may be the closest thing yet to a kit airplane. The Federal Aviation Administration, which certifies aircraft, has never approved a kit (exception: some Schweizer sailplanes). It insists that "more than 50

percent" of the work on amateur-built aircraft be done by the amateur.

Bede has got around this by offering some of the parts ready-made, and the rest as raw materials, uncut but with some of the difficult parts already formed. He also offers supplies right on down to the necessary number of nuts and bolts to put it together. The builder, says Bede, "will still have to do 80 percent of the work, but he'll have everything he needs to do it with."

But before you think about building the plane, you'll want the answer to one question: How does it fly?

I flew the prototype, and I would say, "Better than most." Forget sporty routines. It isn't built for that. It's definitely a cross-country type, and a good one. Stick the golf clubs in back, the wife up front, and go, man!

Takeoff, after a normal roll, was at

*Photos by Don Pratt*



**BOLT-TOGETHER CONSTRUCTION** of fuselage frame allows easier building and lighter empty weight

#### PERFORMANCE ESTIMATES

|                                | Two-place | Four-place |
|--------------------------------|-----------|------------|
| Engine size .....              | 108 hp    | 150 hp     |
| Gross weight .....             | 1400 lbs. | 1700 lbs.  |
| Empty weight .....             | 805 lbs.  | 830 lbs.   |
| Max. speed (sea level).....    | 156 mph   | 186 mph    |
| Cruising speed (65% power) ..  | 142 mph   | 166 mph    |
| Stalling speed (flaps down) .. | 54 mph    | 61 mph     |
| Stalling speed (flaps up) .... | 60 mph    | 66 mph     |
| Maximum rate of climb.....     | 900 fpm   | 1200 fpm   |
| Takeoff run .....              | 600 ft.   | 650 ft.    |
| Landing roll .....             | 500 ft.   | 600 ft.    |
| Maximum range .....            | 1200 mi.  | 1200 mi.   |



70 mph. (The prototype, incidentally, had a 160-hp Lycoming). Climb-out started at 500 f.p.m. and eventually settled at 1200 f.p.m., at about 115 mph, 25 inches of manifold pressure and 2600 rpm. The roll, before we got complete control on the surfaces, was as skittish as most homebuilts, certainly no better.

Once at cruise, however, it really settled down, almost rock-steady. I had to hold slight left, yes left, rudder (Bede claimed some difficulty with spring tension) to prevent yaw, but the stick was a joy. I took my hand off it, tentatively at first, then rested both hands on my knees. Nothing. Straight and level all the way.

Turns were easy enough, nothing sensational, but no chore either.

The cabin, let's face it, was a bit breezy, more than a bit noisy, and so a bit much. Even on short flights it's aggravating, and on long flights it might be a real nuisance, unless you're wearing thermal underwear and ear plugs.

The noise breeze level is probably the BD-4's major fault, and could stand correcting—or caulking.

Minor faults included some sun glare from the engine cowlings, and the main spar running across the center of the cabin just where my head prefers to rest. I hit it, but Bede, who is shorter, didn't. (Bede later raised it two inches, without—he says—sacrificing any performance.)

Descent was smooth, with settings at 10 inches, 2200 rpm, 120 mph and 1000 f.p.m. The landing approach (at 95 mph), like the takeoff, was a bit skittish, with the stick working overtime. But this is characteristic of homebuilts. Because of their size, they begin to act like kites at slow speeds. It didn't bother me too much. The touchdown (at 75 mph) was smooth enough.

For the rest, visibility was quite good, the seats comfortable, and, except for the noise and the awkwardness of holding the left rudder, it was an enjoyable flight. I think the plane will wear well on long cross-countries.

On the ground, Jim worked out our true airspeed at 162 mph from an indicated 138 mph at 64 percent power. This compares to 166 mph for a 150-hp engine in his announced performance estimates.

For those who need more detail, complete specifications, performance estimates, a bill of materials and price list are included with the plans.

Here's what is available in plans and ready-made parts:

- **Plans.** These can be ordered directly from *Popular Mechanics* (see page 115). The plans, which run to 40 sheets, are among the most clearly detailed ever printed. Each part—nut, bolt, whatever—is number-coded from sheet to sheet so there can be no possible misunderstanding about what goes

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**'Once at cruise, it  
really settled down,  
almost rock steady.'**

---

where, and all cutting jobs have full-sized templates. Price: \$30.

- **Packages.** Bede has broken down the airplane into seven basic packages of raw materials, which can be ordered separately, or en masse, or even one part at a time. For a complete aircraft (minus engine) the seven packages cost \$2940.

The seven separate packages are:

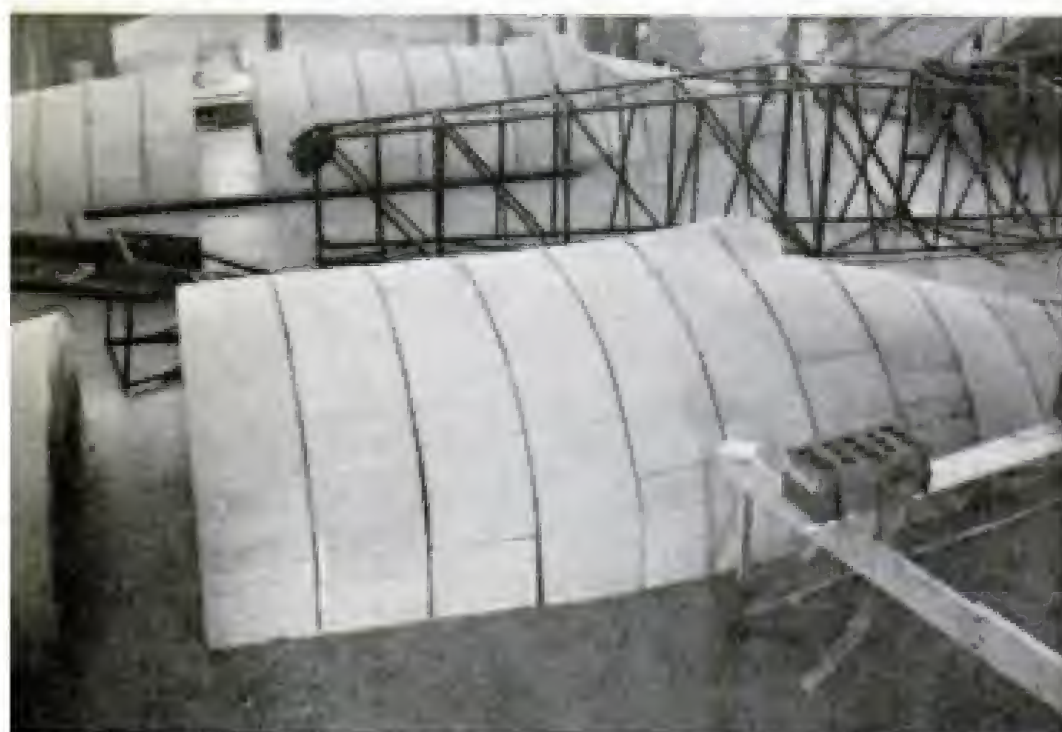
1. **Wings.** The package includes extruded metal-beam spar and plastic panels that slip over the beam and overlap one another. The inboard panels double as gas tanks. The beam originated in the low-wing BD-1, and the plastic panels were first designed for the Demoiselle. The wing is the most complete of all the parts offered by Bede—just put it together—and it is *PM's* suggestion that if you buy the plans, and are serious about building the BD-4, you should at least buy the wings from Bede. You'd have considerable trouble—unless you're an expert—duplicating the extruded beam and plas-

(Please turn to page 208)





# HOW TO BUILD A WHALE

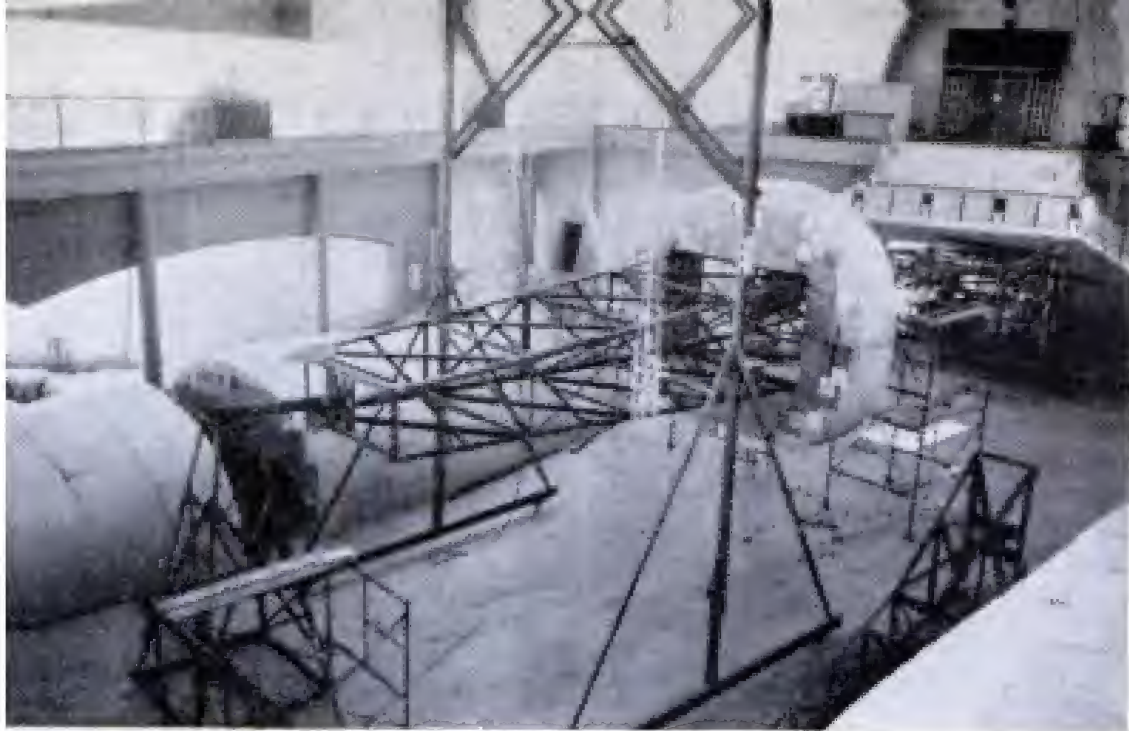


It takes \$200,000, 21,000 pounds of polyurethane, fiberglass and steel, plus two years' work, according to New York's Museum of Natural History

**B**LUE WHALES are the biggest animals that ever lived—and the new “Blue” in the American Museum of Natural History is the biggest single exhibit in its 100-year history. The 94-foot, 10.5-ton replica, on the drawing board seven years, required over two years to build. Suspended at a single point (creating a floating effect), the whale is in diving position. It replaces a plaster 76-footer first shown in 1908. Knowledge gained since then doomed that animal: Its body didn't bulge right and its eyes weren't protuberant. ★★

- 1 MAN-MADE WHALE** called for careful handwork. The animal was built in a Macon, Ga., factory
- 2 WHALE ARRIVED** at museum in pieces. Assembly is checked on floor of the new Hall of Ocean Life

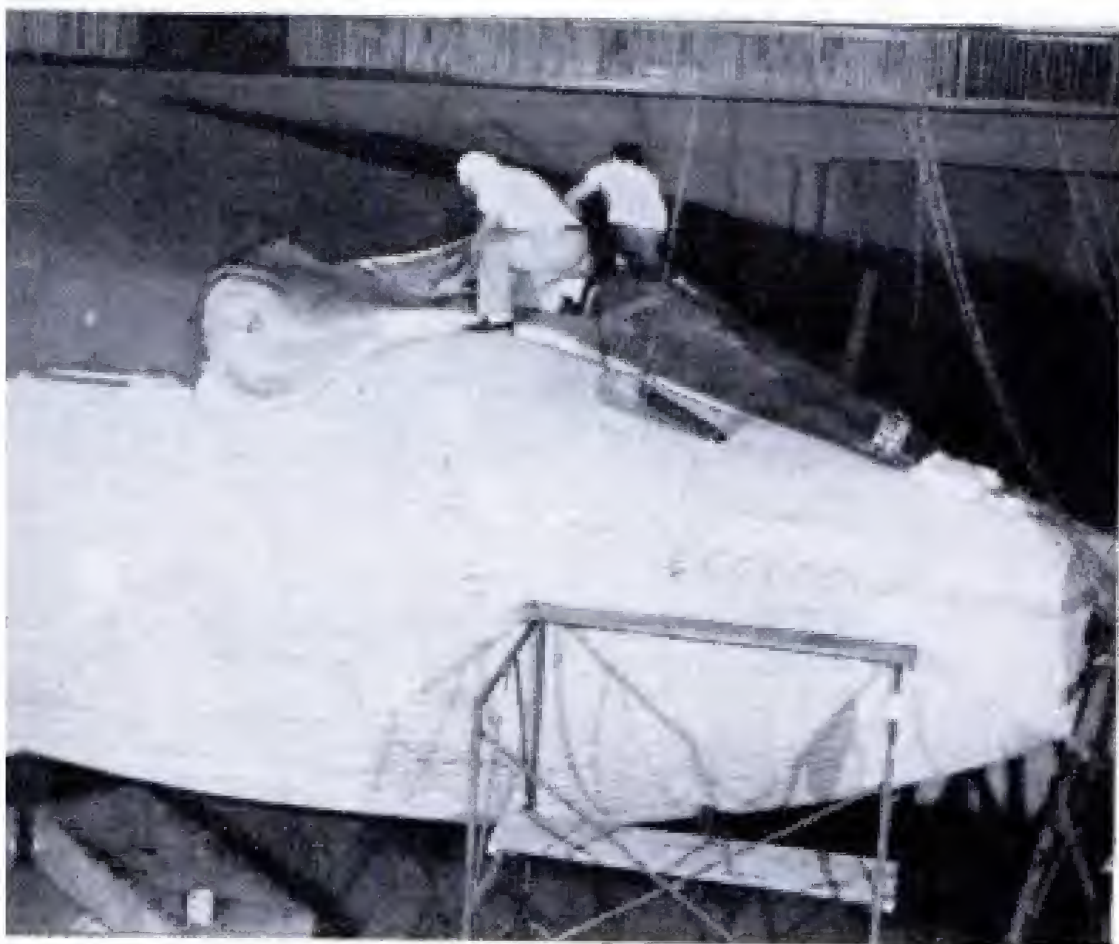




**3** POLYURETHANE BODY "SLICES" are carefully placed in position over steel skeleton held in a jig. Body was built in two large sections



**4** LOOKING LIKE HUGE LOAF of bread, completed main section awaits finishing touches. Polyurethane foam forms a firm bond between slices



**5** FIBERGLASS is applied over polyurethane to provide a smooth, strong base for paint. "Blues" look blue in water, really are black and gray



**6** LOCKING DEVICE is used to bring together 28-foot tail and 66-foot body. Mechanism connects to steel pipe anchored in reinforced ceiling



**7** TRICKY MOUNTING JOB required the know-how of steelworkers. Body sections were raised to the ceiling by muscle power and chain hoists



**8** HUGE SIZE OF MODEL is not as great as real thing. Females, larger than males, may grow to 100 feet in length and a weight of 175 tons



**OSCILLOSCOPE:**  
Monitors electrocardiogram (EKG), pressure, volume, etc.

**HEART-RATE METER:**  
Indicates heart beats per minute

**EKG CONTROL PANEL:**  
Triggers electronics on EKG signal

Used for external pacing

Control panel for pneumatics system

**GAS SELECTOR:**  
For internal or external gas supply to pneumatic system

For monitoring purposes

**VOLUME METER:**  
Shows displacement of gas

**CONTROL PANEL:**  
Provides proper timing for inflation and deflation of pump

**MASTER CONTROL CYLINDER:**  
Controls gas displacement of intra-aortic pump

**POWER SWITCH**

**ELECTROCARDIOGRAM ELECTRODES**

**GAS LINE**

**AORTA**

**BALLOON**

**SPINAL COLUMN**

**FEMORAL ARTERY**

**CIRCULATORY ASSIST DRIVE  
AND CONTROL CONSOLE FOR INTRA-AORTIC PUMP**

**HEART PATIENT**

## MECHANICS OF MEDICINE:

# New Tools

By KENNETH N. ANDERSON

**M**ECHANICAL DEVICES and artificial organ parts to extend the period of usefulness of worn or damaged human hearts are being developed and tested in leading laboratories.

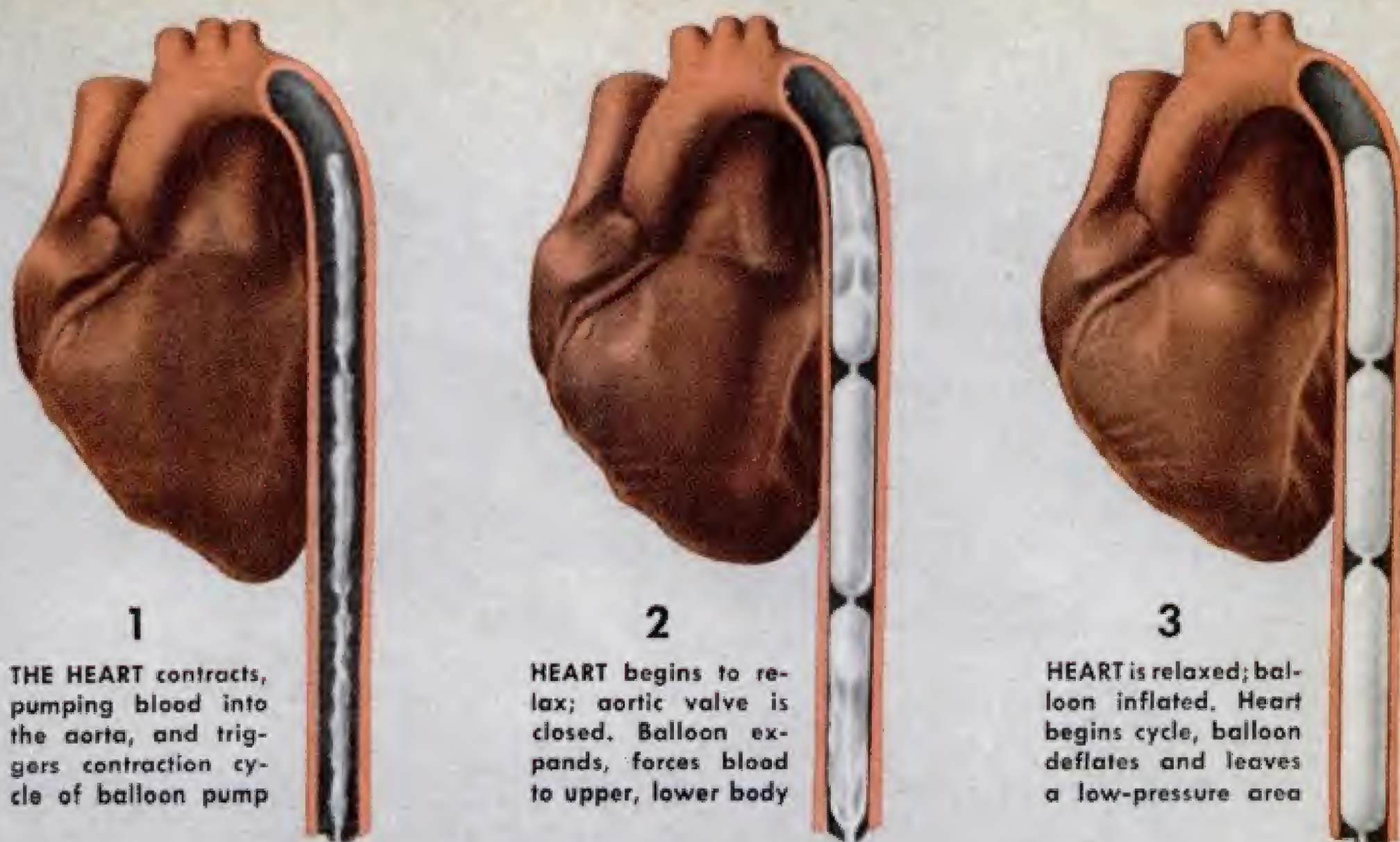
Artificial hearts and auxiliary aids still offer the best hope for saving the lives of heart patients in the future, according to many medical scientists. The age-old medical dream of transplanting a human heart from one individual to another has been achieved, first by Dr. Christian N. Barnard, and later by other surgeons throughout the world. But it is not a feasible solution to the problems of an estimated 20 million heart-disease patients and a half-million fatal heart attacks each year—the current record in America.

In its normal condition, the human heart is one of the most efficient machines known. It converts 50 percent of its available fuel into work; an automobile engine or a steam turbine, by comparison, may have a mechanical efficiency of only 25 percent. The heart

expands and contracts 100,000 times a day in order to move 32,000 pounds of blood through its chambers. The only rest it gets is during a fraction of a second pause between beats. And the heart receives no direct nourishment from the thousands of gallons of blood that it handles each day. It is sustained only by tiny coronary arteries on the outside of the fist-sized bundle of muscles. And the coronary arteries depend upon a sort of backflow of blood from one of the large arteries near the heart.

By the time you reach the age of 35, your heart will have gone through its pumping action almost one and a half billion times and, usually, will have begun to show some signs of wear. When failure occurs, it usually is due





Successful heart transplants have brought us closer to the ultimate answer—the artificial heart. Meanwhile, researchers are coming up with ingenious solutions that point the way to the completely mechanical heart

## for Mending Hearts

*Illustrations by Jack Mitchell*

to blockage of a coronary artery. The bore of the tiny arteries gradually narrows because of an accumulation of fatty and calcified material, making it easy for a blood clot to form and block the flow of nutrient-enriched blood to the heart muscles.

When a coronary artery is blocked, the heart usually continues to beat but a portion of the heart muscle is deprived of blood and is weakened. If the patient is placed in a condition of complete rest, his heart does not have to carry its normally heavy load and will gradually recover. Over several weeks, new coronary artery channels will develop to compensate for the loss of blood supply.

A gas-driven balloon pump, devel-

oped by the Avco Everett Research Laboratory, was designed to reduce the heart's workload while the organ goes through its normal healing processes. Known as an IAP (for intra-aortic pump), it consists of a 10-inch-long balloon,  $\frac{3}{4}$  of an inch in diameter, with a thin gas tube running down its center. It is connected to an external drive and control unit synchronized to the heartbeat.

The balloon is threaded into the femoral artery through an incision in the upper thigh and then pushed into the aorta, the major trunk artery leading from the heart. Electrodes are attached to the patient's skin to transmit electrocardiogram signals to the control unit. The signals, caused by tiny elec-



trical pulses emitted when the heart muscles contract, activate the contraction-expansion cycles of the balloon pump.

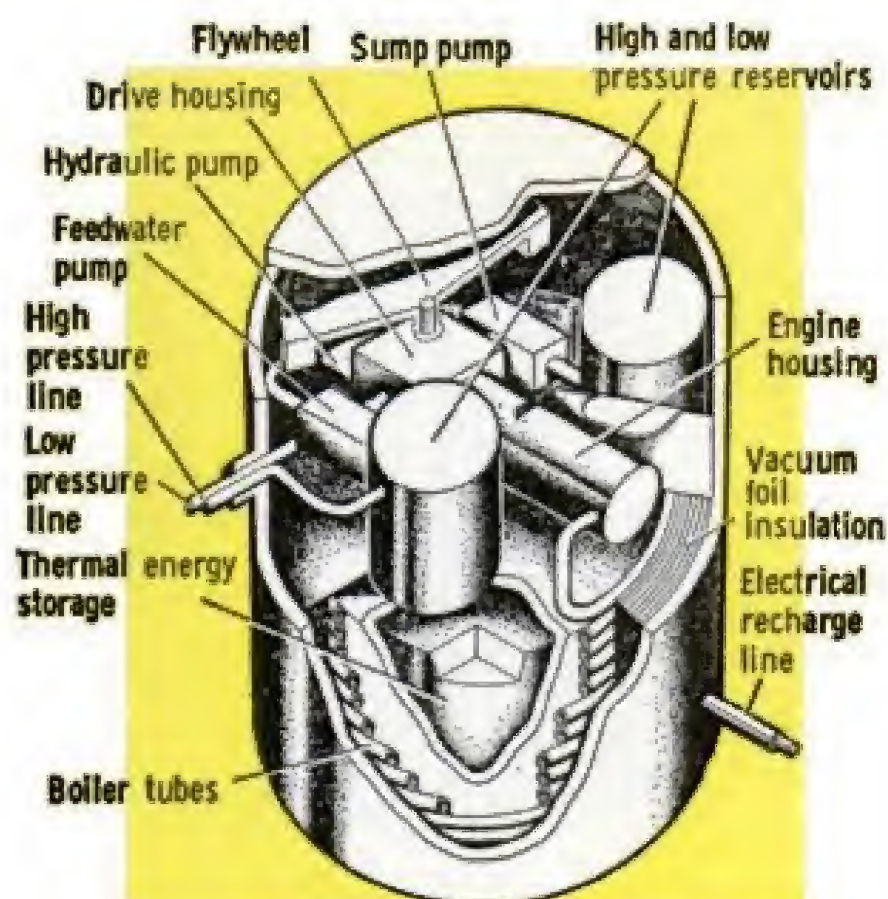
After the heart empties into the aorta and begins to relax, gas fills the balloon, causing it to expand and push the blood into arteries connected to the aorta. At the same time, some blood is forced back into the coronary arteries. When the heart begins to contract again, the balloon deflates, creating a low-pressure channel into which the heart can empty its blood load.

The IAP was developed by Dr. Arthur Kantrowitz, director of the Avco Everett Research Laboratory, in collaboration with Dr. W. Gerald Austen and Dr. Mortimer J. Buckley of the Harvard Medical School and Massachusetts General Hospital. According to Dr. Kantrowitz, a brother of the noted heart surgeon, Dr. Adrian Kantrowitz of Maimonides Hospital in Brooklyn, N.Y., the IAP can reduce the workload of a damaged heart by up to 50 percent. Not only does the heart work less during its period of recuperation, but it gets more blood itself through the back-pressure effect that fills the coronary arteries.

Installation of the IAP devices requires only a local anesthetic that can be inserted in a few minutes and easily removed when the heart has recovered sufficiently to resume its normal workload.

The main problem facing medical scientists before the balloon pump can be made available for general use is finding a plastic balloon material that does not cause blood clotting. The device has been used in animals for periods of a month or so and the researchers have discovered that materials tested thus far cause clots in humans and pigs, but not in dogs.

The National Institutes of Health, which provided money for developing the IAP, now is financing a study of what makes blood clot. The present balloon pump material causes human blood to clot in about one hour, com-



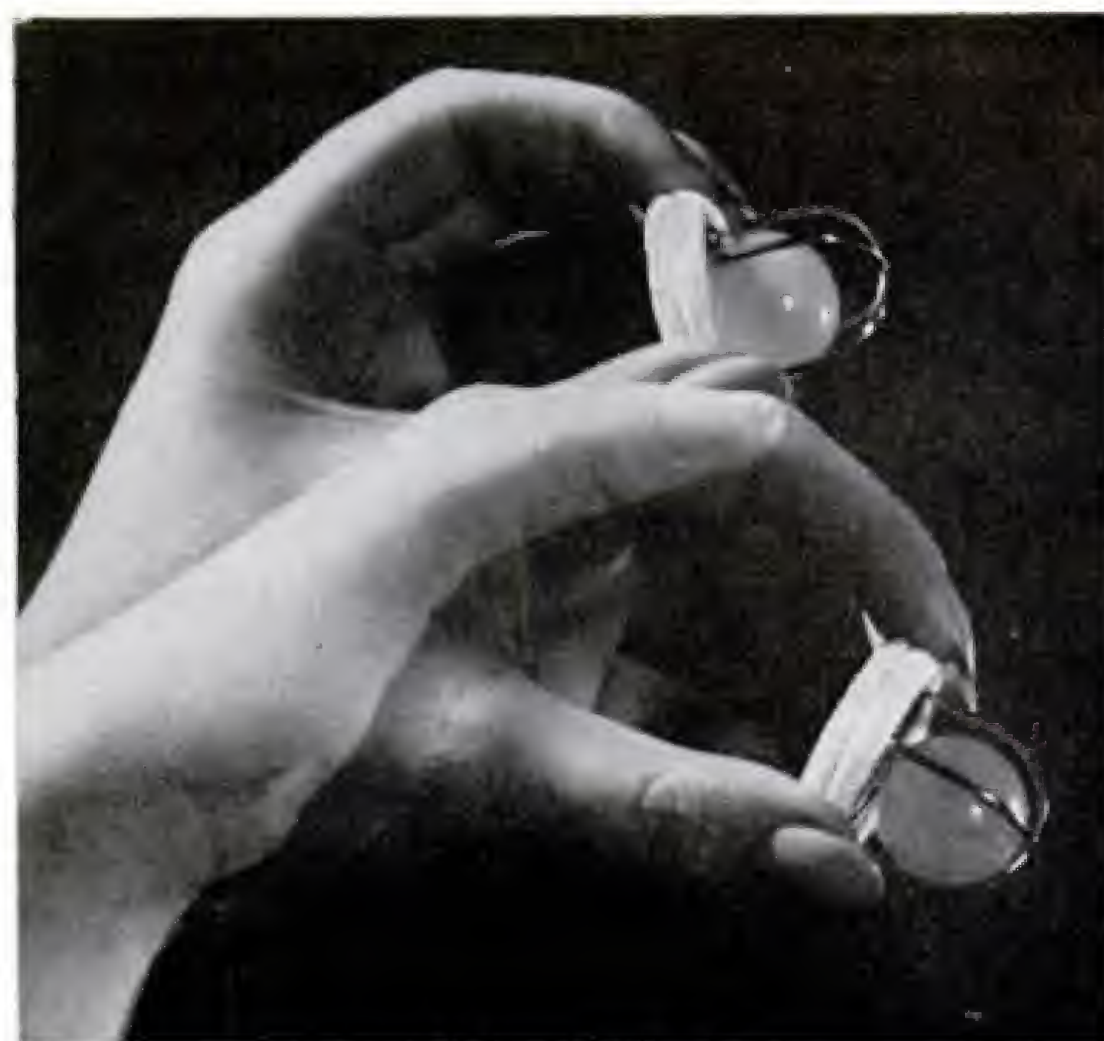
POWER SOURCE FOR IMPLANTABLE CIRCULATORY ASSIST DEVICE

**NUCLEAR-POWERED HEART** (a conceptual design) would function as a tiny steam engine implanted in pelvis where it would be connected to an artery and vein and function as a self-sufficient mechanical heart

pared to 30 minutes for polyurethane and five minutes for glass.

#### Dacron-coated ball valve

Meanwhile, NIH has solved a blood-clotting problem that has interfered with the effectiveness of artificial heart valves. The metal frames of Star-Edwards ball valves tend to collect blood clots when the bare metal is exposed;





there's danger that clots will break free and flow into a small artery, thus blocking it.

Now, Dr. Andrew G. Morrow and Dr. Nina S. Braunwald of NIH have achieved success in preventing such clotting by coating the valve frames with Dacron fabric. The coating, thin enough so it will not affect clearances, is applied to all nonmoving parts. So far, 22 patients have worn the fabric-coated frames up to 12 months with no signs of clot formation.

#### **Nuclear-powered heart**

Further progress has been reported, meanwhile, in the efforts of NIH, the Atomic Energy Commission, and private industry to develop a nuclear-powered heart pump. A hazard to be overcome, in addition to radiation exposure itself, is that of heat produced by decay of the isotope, plutonium 238, which would be the energy source.

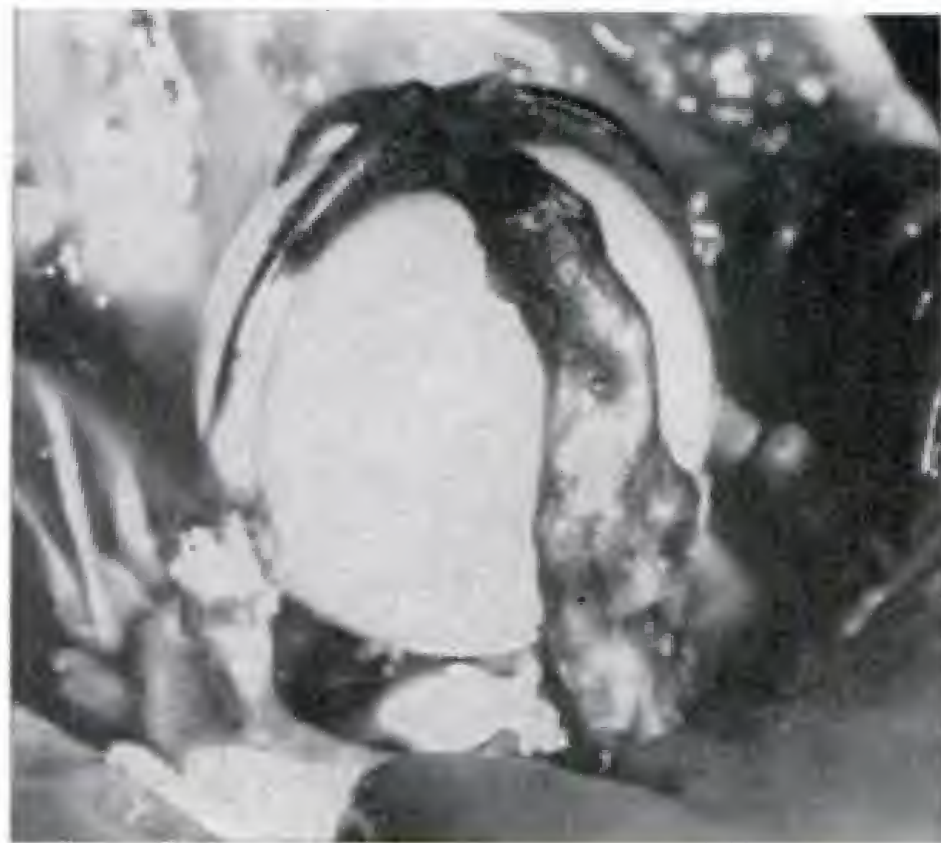
The nuclear-powered heart would function as a tiny steam engine, including a miniature boiler, with pumps attached to the arterial and venous parts of the blood system. Blood pump models, powered by external sources, have been tested in six cows in previous experiments. But the nuclear device would be implanted in the pelvis of a

human, where it would be connected to an artery and vein, and it would function as a self-sufficient mechanical heart.

The heart problem, similar to that experienced by nuclear-powered electric generators with resultant thermal pollution, occurs because of the difficulty in converting all energy of radiation energy into mechanical work. Heat output may be 10 times that derived from the atom. The Thermo Electronic Corp. of Waltham, Mass., claims it has now developed an effective heat exchanger which dumps the excess heat into the aorta. Blood flowing through the main artery would dissipate the heat throughout the body.

An experimental heat exchanger has been implanted in a test animal for studies that will lead eventually to modifications for use in humans. It contains a cavity  $1\frac{5}{8}$  inches in diameter into which a 16-watt disc of plutonium 238 is inserted. The exchanger is coated with layers of thermal insulation and other materials to protect body tissues. A titanium alloy tube through which the blood flows is coated with a graphite-heparin complex to reduce the possibility of clotting. After eight months' testing in an animal, the exchanger has been declared successful. ★★

**ARTIFICIAL HEART VALVES** tend to collect blood clots that reduce their effectiveness. If clots break free, they may block small artery and endanger patient's life. Ball valve with metal frame (far left) is shown clotted with blood (below) after implantation. No clots have formed on the heart valve frame that is coated with Dacron fabric. Technique was developed by National Institutes of Health researchers





## PM TESTS

# A Rugged New Camper... A Controversial New Park

Redwood National Park, newest big-timber camping spot, is a natural proving ground for El Dorado's new camper and Ford's new pickup truck.

By V. LEE OERTLE



**L**OGGING ROADS can provide more punishment for a vehicle than any other kind of road. I'm finding that out in the brand-new, controversial Redwood National Park while testing Ford's 1969 Camper Special pickup with a new nine-foot El Dorado coach aboard. My guides are National Park Ranger Powell White and California State Ranger Terry Adams.

We are driving in the undeveloped part of the 58,000 acres tagged by Congress as Redwood National Park. Though Congress has approved the park concept, it will be some time before all the land comes under National Park Service control. At present, 27,468 acres belong to the California State Park System. This land, which has three popular camping areas, eventually will be turned over to the Park Service. The remaining acreage is under direct park service administration, but undeveloped. Until Congress acted, it was lumber-company owned—about 10,000 acres of it containing old-growth redwoods. It's in this section that we are testing equipment.

At this time of year (November) Redwood National Park is a rain forest. Rainfall in this region averages about 100 inches a year. The best and driest season is from spring to late fall, but to avoid crowds, pick the winter months. Right now,

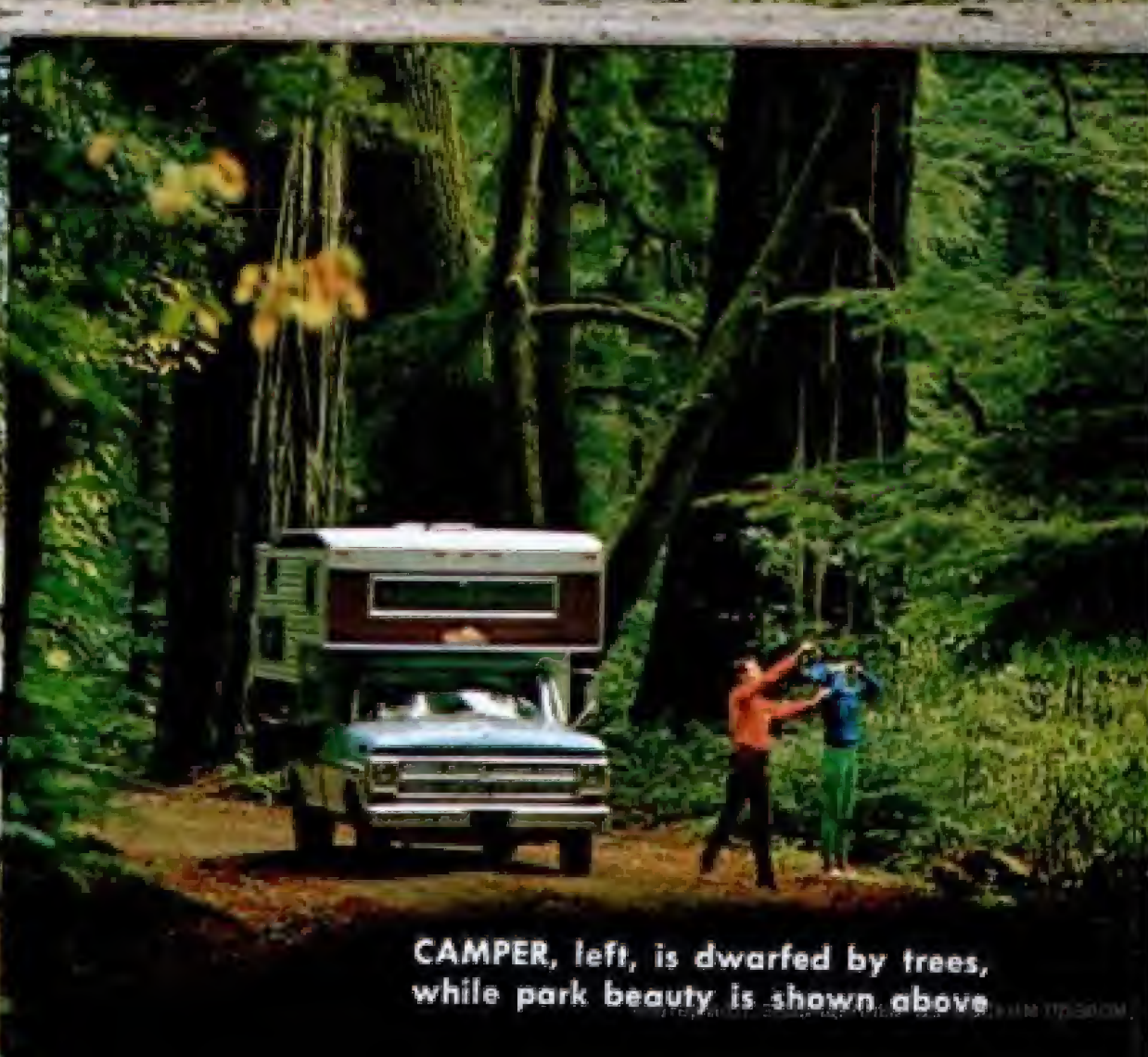
**LOCATION** of brand-new Redwood National Park







TALLEST REDWOOD, left, is a 367-foot giant compared to people shown in foreground



CAMPER, left, is dwarfed by trees, while park beauty is shown above



the new section of the National Park is accessible only over lumber-company roads. In some cases, you need special permission to use the logging trails, so check with park rangers before entering unused regions.

Up ahead in a four-wheel-drive patrol vehicle, my guides slip and bump over the muddy logging road which twists through the perpetual twilight. The redwoods here are so thick and big around at the base—up to 20 feet—you can hardly see where you're going.

We are heading for the boundary between new park and what is still private land. The  $\frac{3}{4}$ -ton Ford pickup with 1500 pounds of coach aboard is able to keep up with the more maneuverable patrol vehicle. The Twin-I-Beam front suspension and Flex-O-Matic rear suspension are made for off-level travel.

Though the total weight of truck and coach is 7000 pounds, the extra-wide 10x16.5-in. super single tires give great flotation on the rough roads. The tires are not standard with the Ford 250 Camper Special. But it's a good idea to get them if you plan any driving along logging roads or in rain forests.

Logging trucks can loom up out of nowhere in this back country. Barrel- ing around corners at high speeds, sliding on a dozen or more tires, they

throw up a solid wall of mud-spray as they come charging down the mountain. If you do find yourself on a logging road, keep well to one side. If you hear something coming that sounds like a wall of water from a busted dam—get off the trail fast!

As one old-timer told us, "Log haulers don't slam on the brakes for anything until they hit the bottom of the valley. All that weight would just send the brake linings up in a puff of smoke!"

At this point, Ranger Adams pulls off the road to the right, skids around in a full circle on deep red mud, and waves frantically at me to stop. He sticks his head out the window and yells, "Hold it! Road's washed out ahead."

We park and walk a little way out onto a bluff. On the left, 300-foot trees march solidly up to a stump-dotted ravine. It appears as though some giant claw had slashed through the ancient redwood groves. On the one side, dense forest. On the other, barren hills and fire-blackened stumps. No one says anything for awhile. It gets to you. Finally, I point at the line of demarcation between trees and no trees, "Is that where the National Park boundary begins?" I ask.

Lowell White nods silently.

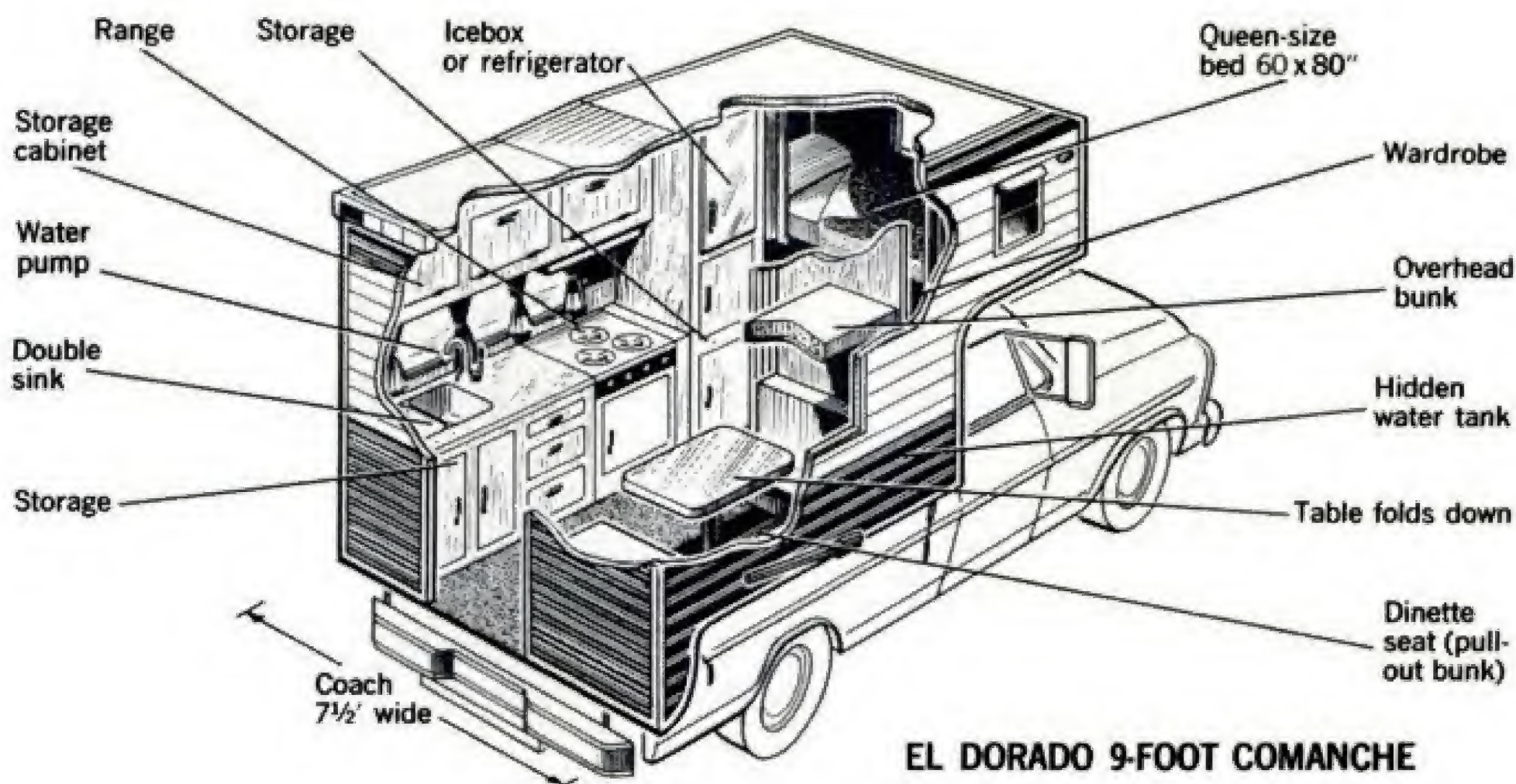
White's job is to help plan the devel-

**DEVELOPMENT** of Redwood National Park is now in planning stage. Eventually, the park will include 58,000 acres of prime land for outdoor recreation

**TIRE CHAINS** are always good to have for back-country travel. Sudden rains can turn a hard-dirt road into a muddy bog. Note the oversized tires







**EL DORADO 9-FOOT COMANCHE**

opment of the newly acquired redwood lands and the California parks. Should the complete park be operated like Yellowstone and Yosemite with vast campground complexes and large permanent staffs? Or should it be sectioned off into many smaller segments in an attempt to retain its primitive atmosphere? These are only some questions facing Ranger White in the field and Nelson Murdock, the first superintendent of Redwood National Park.

What does this mean to the average camper? For the moment not much has

changed. California will continue to operate the three extremely popular campgrounds within the Redwood National Park region: Jedediah Smith State Park, Del Norte Coast Redwoods State Park and Prairie Creek Redwoods State Park. Facilities at those locations are excellent.

Up here in the new park, I spend each night listening to rain dripping off branches hundreds of feet over the camper roof. Every morning, as I ready our gear for the day, I see the subtle changes wrought by rain forests. Shoes

*(Please turn to page 210)*

**SANITARY DUMPING STATIONS** are available in the parks operated by the State of California. These parks soon will be added to the federal lands

**STARK CONTRAST** between the federal park land and privately owned lumber territory. The new Redwood National Park starts with the treed area





# From Florida to Cape Cod— Without Moving

**Hitchhiking a ride on the Gulf Stream, Dr. Jacques Piccard will turn off the motors of his unique submarine and drift on an amazing underwater voyage.**

By WALLACE CLOUD

**W**HEN I CLIMBED UP THE SLOPING DECK of the submarine from a rubber boat, she was in the last stages of fitting out at West Palm Beach. (It seems awkward to call a sub named *Ben Franklin* "she," but there's no way around it.) By now test dives have taken place, and soon she'll be towed out to sea, with Jacques Piccard, a Grumman skipper, and Navy scientists aboard. The *Franklin* will sink and remain submerged for a month or more, slowly drifting some 1500 miles up the Gulf Stream like an undersea *Kon-Tiki*.

Throughout the voyage, Dr. Piccard told me, the sub may remain in the same cubic mile of seawater as it moves from Florida to the vicinity of Cape Cod. In the

Artist's concept of the *Ben Franklin* as it leaves the Blake Plateau (background) and begins descent to 2000 feet. Band of light blue is deep-scattering layer of plankton (shrimp and small fish) around which tuna swim. Stripers feed at the edge of the Plateau and giant sea squid lurk in the depths.

BEN FRANKLIN IN PREVIOUS POSITIONS

BLAKE PLATEAU

MAGNETOMETER

PROPULSION  
MOTOR

Illustration created exclusively for Popular Mechanics by renowned oceanographic artist, Ed Valigursky



SUPPORT VESSEL

SUPPORT VESSEL

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MEASURING DEVICES  
FOR TEMPERATURE,  
SALINITY, DEPTH,  
SOUND, VELOCITY

SONAR

TRANSMISSOMETER

AMBIENT  
LIGHT METER

CURRENT  
METER

SENSOR

TELEPHONE

35-MM STILL  
CAMERA

SIDE-SEEING  
SONAR

70-MM CAMERA

TURBULENCE  
METER

SUB-BOTTOM  
PROFILER







DR. JACQUES PICCARD, designer of the *Trieste*, in conning tower of the *Franklin* at port of Palm Beach



ENGINEERS CHECK WIRING in control area of the *Franklin* prior to test dives. Wardroom is beyond



gloom 300 to 2000 feet below the surface, the six men aboard will get to know that volume of water intimately. They will monitor its changes in temperature, observe the intrusion and diffusion of surrounding water, and watch the marine creatures that enter and leave their moving cell of fluid. In a submarine that floats soundlessly at any depth down to 2000 feet, they will become a part of the Gulf Stream, that river in the sea that carries 22 times as much water as all the land rivers of the world. Under tons of pressure, they must trust the Gulf Stream to take them for a ride; they will trust their vessel, designed by Grumman Aircraft Engineering Corp. and Dr. Piccard, to bring them safely through it.

A man of enormous drive, Piccard has already been to the deepest spot in the ocean, the bottom of the Marianas Trench, 35,800 feet down in the Pacific. He went there for the U.S. Navy in the bathyscaphe *Trieste*, which he designed with his father, Prof. Auguste Piccard, the famous stratosphere balloonist.

Before christening, the *Ben Franklin* was designated PX-15—the 15th Piccard experimental design. The numbers start from the world's first bathyscaphe, FNRS-3, which the Piccards built for the French Navy. *Trieste* was their next bathyscaphe. Another vessel, the *Auguste Piccard*, built in 1963, carried 30,000 sightseers into the depths of Lake Geneva.

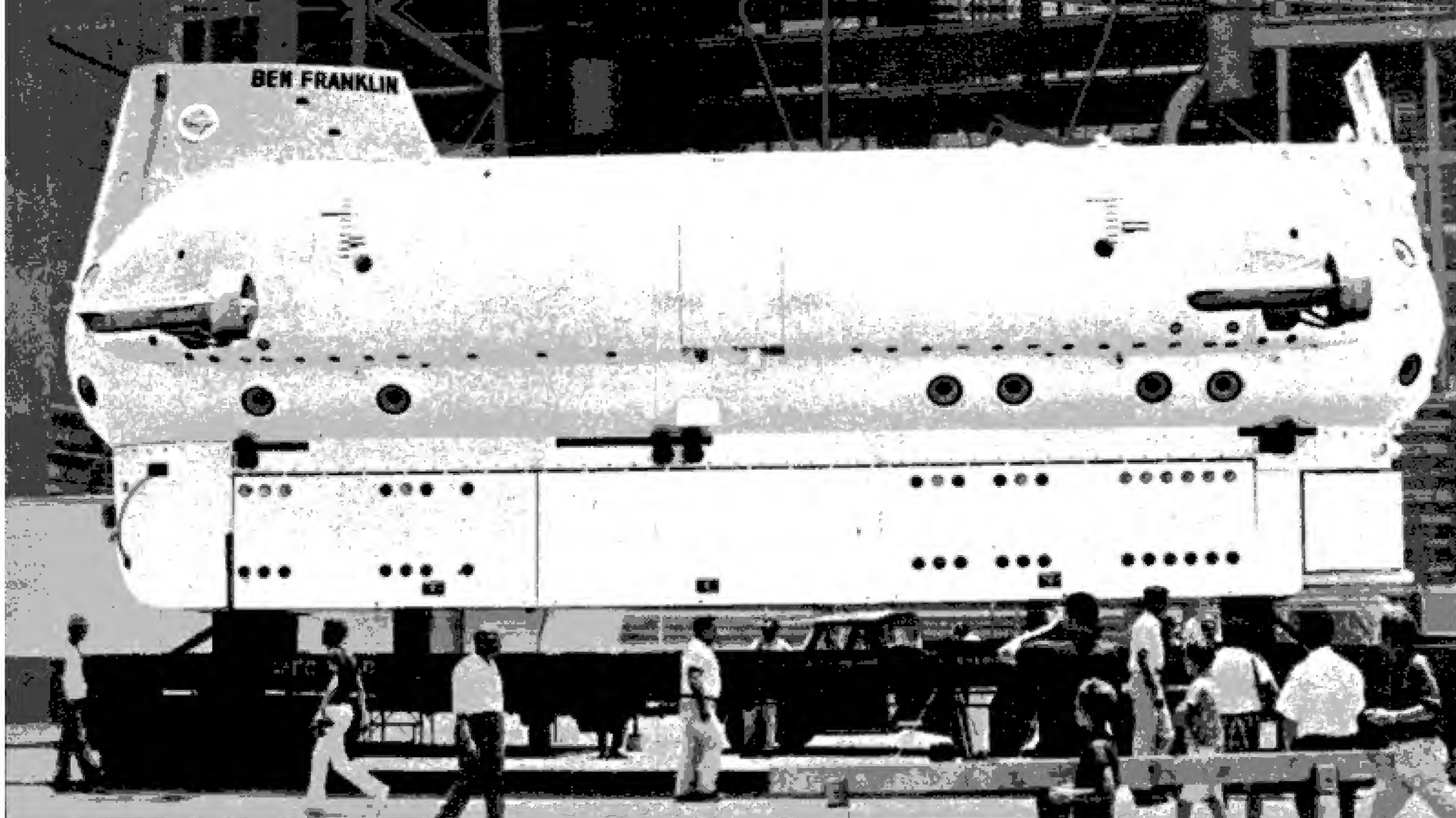
In September, 1964, Piccard announced plans for the Gulf Stream drift. He didn't know where the funds might come from—but then along came Grumman Aircraft Engineering Corp. Construction of the PX-15 began in March, 1967, at Monthey, Switzerland. Grumman has spent \$2.5 million on the project so far, owns the *Ben Franklin*, and employs Piccard as a full-time consultant.

The Naval Oceanographic Office, which is participating in the Gulf Stream mission, is the first "customer"

VACUUM-JACKETED TANKS (left) will hold water (to prepare freeze-dried food) at 210° F. for month

POPULAR MECHANICS





**BEN FRANKLIN** is simple in basic design. Hull is 10 feet in diameter and capped with hemispherical ends. Length overall is 48 feet 9 inches. Four swiveling 25-hp electric motors jut from the hull, two at each end

to use the *Franklin*—a “mesoscaphe” or submarine designed for middle depths. Her maximum cruising depth is 2000 feet.

When I visited the sub at Palm Beach, engineers were busy making sure the boat will do everything required of her. Mooring lines held the yellow-and-white sub well out from the concrete bulkheads of her slip. She rolled a surprising amount, and that was the simplest way to avoid damage to the fiberglass ballast tanks and the motors, which project at the sides, said her skipper, Don Kazimir, a former Navy submariner.

The *Ben Franklin*, although a highly sophisticated research vessel, is surprisingly simple in design. Her pressure hull is a cylinder 10 feet in diameter, stiffened with 16 rings inside and capped with hemispherical ends, all welded of 1 $\frac{3}{8}$ -inch high-strength steel. Total length is 48 feet 9 inches. Slung beneath the hull is a “keel” consisting mainly of 26 tons of lead-acid storage batteries in an aluminum framework. Above the hull is a narrow metal deck, with a small conning tower forward. Bulging below the sides of the deck

are ballast tanks. Four swiveling 25-hp electric motors jut from the sides of the hull at each end.

Inside, the sub was like a long corridor lined with bunks, workbenches and electrical gear. A portable air conditioner on the dock was blowing cold air into the forward hatch. Florida sunshine penetrated the clear water outside to pour through the three-inch-thick plexiglass windows in the ends of the hull (there are 29 viewports in all). Kazimir said a community of barnacles had already adopted the *Franklin*, some living comfortably on antifouling paint around the portholes. With no way to get out and wipe the windows, it's a question how good visibility will be by the end of the trip.

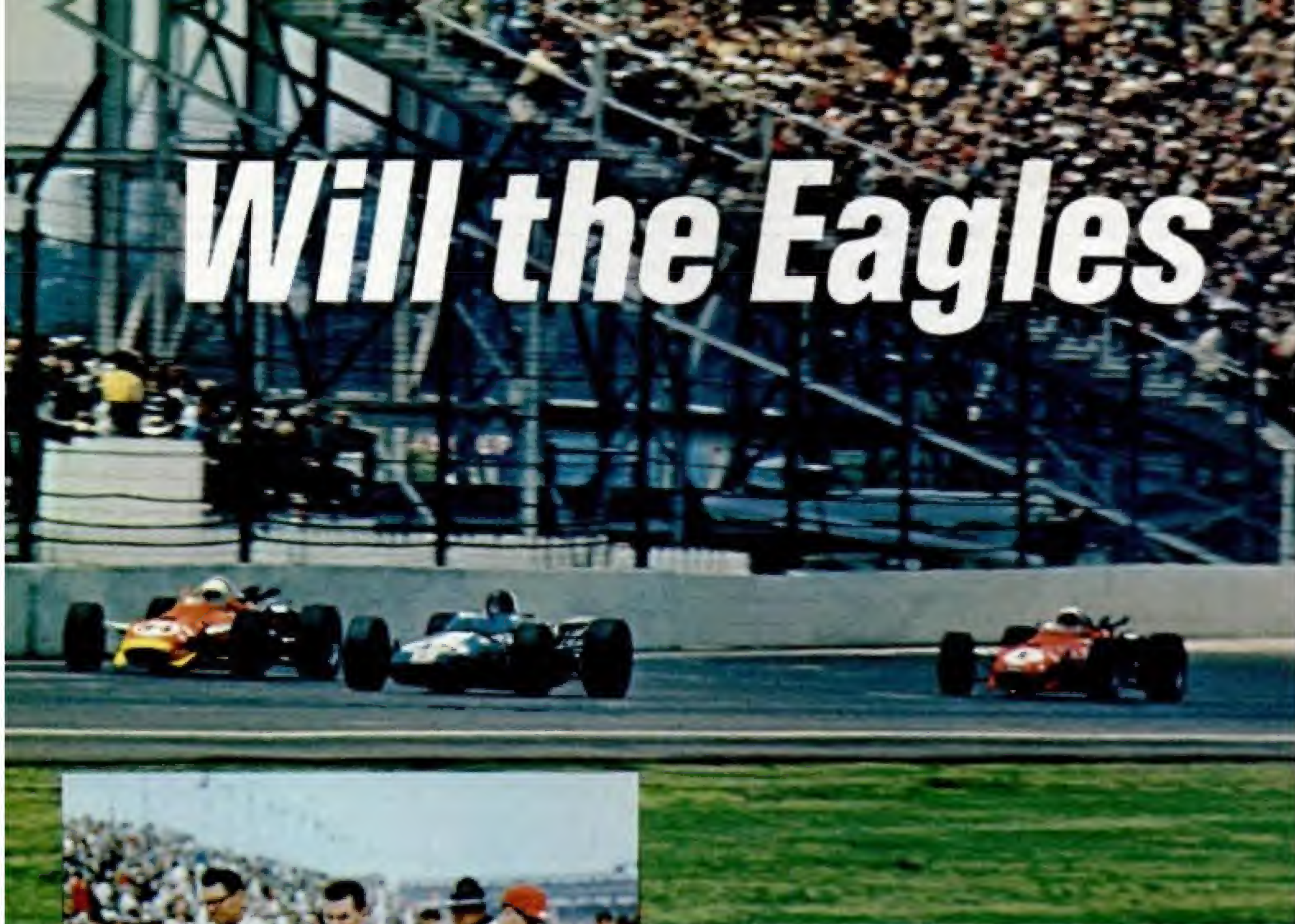
In the cockpit, engineers were checking out motor controls and power circuits. Divers beneath the hull were spotting faulty electrical connectors which had to be replaced before test dives could begin. Using electrical equipment in saltwater is the biggest operational difficulty facing the crew, Piccard told me.

Going through the hatch, I noticed a

*(Please turn to page 212)*



# Will the Eagles



**DAN GURNEY** dices with three-time winner A.J. Foyt (right) and Carl Williams (left) at early point in last year's race. Gurney completed the full 200 laps, finished second. Williams drove 163 laps for 15th spot, Foyt 89 laps for 20th

**CHECKING A CAP SEAL** on his Coyote before start of '68 race is A.J. Foyt, who this year entered two new cars, both powered by turbo-charged Ford engines. Foyt has his heart set on becoming only man to win Indy "500" four times

*Photo by Robert P. Crossley*

**THE OLSONITE EAGLE** Gurney drove to second place last year later went on to win events at Mosport and Riverside. Throughout campaign, car was powered by stock-block pushrod Ford, same engine Dan may use for this year's Indy classic





# Scream Again?

**All-American Racers' Eagles finished 1-2-4 at Indianapolis last year. This year's hot flock by Gurney & Co. will be even thicker**

By BILL KILPATRICK, Auto Editor /Photos by Stanley Rosenthal

**T**HE MOMENT you walk in the door of Dan Gurney's "store" in Santa Ana, Calif., you know right off the bat what the principal activity is. The framed photographs and plaques hanging on the walls, the glistening trophies, the publications scattered on the waiting room tables all spell one thing—auto racing, and lots of it.

In fact, keeping an ear tuned to the conversation between the steady flow of vendors, suppliers, friends, well-wishers and Gurney personnel darting in and out will tell you specifically what race—or type of racing—is on everybody's mind at the moment.

You can bet the chatter at All-American Racers these past few months has been all Indianapolis and the annual 500-mile race. For AAR, through Gurney himself as a driver, and through the Eagle cars his organization designs and builds, has a big stake in Indy.

Last year, '68 USAC champion Bobby Unser won the race in an Eagle. Second in another Eagle was Gurney. Fourth in yet another Eagle was '68 Can-Am king Denis Hulme.

Bend the arm of anyone involved in fielding a race car and they may allow that finishing first is better than a poke in the eye. But when cars upon which a dedicated team has lavished its time, talents, energies, hopes and enthusiasms finish 1-2-4 in the world's richest, most prestigious auto race . . . well, it all

seems somehow worthwhile.

"The only trouble with that sort of success," Gurney will say with a wry smile, "is that nothing less than repeating in kind—perhaps even more so—will seem entirely satisfactory."

But considering the number of Eagles slated to see action at Indy this month, Gurney and his organization stand a pretty good chance of doing just that—repeating in kind, perhaps even more so.

Leading the assault of new aerodynamic Eagles will be Gurney himself. He'll drive one of two cars earmarked for his use; the second will serve as a backup. A third new car will be driven by Hulme as a member of the AAR team. A fourth new Eagle is in the hands of engine whiz Smokey Yunick, who—as this is being written, in mid-February—has yet to name a driver.

"Vintage" Eagles (all '68s) on hand for practice this month probably will be piloted by such stars as Bobby Unser, Gordon Johncock, Roger McCluskey, Jerry Grant and Ronnie Bucknum. Just how many Eagles will be on the grid following time trials May 17-18 and May 24-25 is, of course, up for grabs. But it's safe to say that come race day, May 30, All-American Racers will be able to see a fair sampling of its handiwork in action.

"Our '69 Eagle car building program was held up for a couple of reasons," Gurney explains. "For one thing, we





**AL UNSER** hit the wall last year when the right front spindle of his car let go during the 41st lap. He man-

wanted to wait and see what rule changes USAC would issue pertaining to Indy. For another, some of our engine-development work was behind schedule a bit, and that delayed some of our final decisions.

"And then, of course, there's the fact this is a bucks-up business and we just didn't get firm orders in time to build as many new cars as we would have liked to. As it is, I think we'll be going to Indy with the finest two-wheel-drive cars ever seen out there."

Gurney plans to field his Eagles powered by one of three special Ford engines: 161-cu.-in. turbocharger, 320-cu.-in. pushrod or 305-cu.-in. pushrod, the latter two with Gurney Eagle heads.

"The turbocharger is said to crank

out about 700 horsepower," Gurney said, "but we've never gone to Indy with more than 550. Even considering how well we did last year with the 305 engine over the season, it's hard to ignore all that turbocharged power, so we'll look them all over pretty carefully."

Even if Gurney decides against the turbocharged Ford, the engine will have several proponents this year. Three-time Indy winner A. J. Foyt will use it in his new Coyote, Parnelli Jones plans to install one in the Lotus chassis Joe Leonard put on the pole last year when the car was turbine-powered, Mario Andretti will use the engine in his new four-wheel-drive Lotus, and Al Unser (brother of Bob) will have one in a new four-wheel-drive



**TURBOCARS** of Hill (70) and Leonard (60) battle with Bobby Unser for first-turn honors at start of '68 race





aged to scramble clear, but debris from the crash eliminated both Arnie Knepper and Gary Bettenhausen

Lola being masterminded by Indy veteran George Bignotti. This last one could be a red-hot car in that Bignotti did much of the development work on the turbocharger and presumably knows its whims and whams.

Not without its advocates, of course, is the tried-and-true turbocharged Offy, the engine that powered Unser to victory last year. He'll use it again, possibly in an Eagle or in a new four-wheel-drive Lola, as will '68 third-place finisher Mel Kenyon and the veteran Lloyd Ruby. The latter's new car was built by Dave Laycock, is owned by Gene White and sponsored by Wynn Oil. Also slated to use the Offy are such stars as Johncock, McCluskey, Gary Bettenhausen, Bill Vukovich and several others.

Something new at the Speedway this year will be at least two Chevrolet engines, one a 320-cu.-in. pushrod that may wind up in a four-wheel-drive Lola being prepared by Roger Penske for road-racing star Mark Donohue. At last word, Penske was also flirting with the idea of using the Offy, but his ties to Chevy have always been right out there for all to see. The other Chevy could be a 203-cu.-in. turbocharger in Jerry Eisert's new car, or in the '68 Eagle Weinberger Homes bought from Penske for Ronnie Bucknum. Driver of the Eisert car will probably be Jerry Grant.

No one is too sure what Colin Chapman's annual Lotus invasion will con-

*(Please turn to page 219)*



LIKE SO MANY BEES, Bobby Unser's pit crew swarms all over his winning steed at midpoint in the race



HOW SWEET IT IS! A weary Unser and his relieved wife accept the crowd's tribute after his big win.





### Assembly-line inflation

Weather balloons, undergoing inflation tests, give the appearance of a big circus at the Guide Bridge Rubber Co. in Britain. The firm exports 200,000 units per year.



### Rubbish 'eater' cleans bay

Floating rubbish is "gobbled up" in San Diego Bay by this 20-foot, outboard-powered craft. The trash is lifted by a hopper, deposited on the boat, then carried away.



### Olympic tower in Munich

The Olympia Tower is already standing in Munich where the 1972 Olympic Games will take place. The 900-foot tower, built for television, will be a symbol of the games.



### Fresh air for ground crew

This Bendix cryogenic backpack converts liquid air to breathing air for personnel loading toxic propellants aboard the LM spacecraft. It carries a two-hour supply.





## Matsushita honors scientists

Eleven pioneers in science and industry are honored in a new display placed on the square in front of the Central Research Laboratory of Matsushita Electric in Japan. Ten bronze busts are grouped around a statue (above) of Thomas Edison. The bust shown closeup at left is of Sakichi Toyoda, Japanese inventor of the automatic loom and circular loom. In all, there are five Japanese pioneers and six from the United States and Europe.



## New money transporter in Cologne

A firm that transports money and other valuables in Cologne has designed a new kind of armored car. The valuable items are carried in separate containers—like so many safety deposit boxes—and can be removed only when an authorized person unlocks the elaborate system of electrical and mechanical safeguards.





**FIRST JEEP CAMPER UNIT** should be available this spring. The rig is an 8-ft. El Dorado coach with wheels hooked to 81-in.-wheelbase Jeep Universal. Passengers ride inside coach. Jeep plans unit price under \$5000

# New Camp Rigs for '69

Sharp-eyed quality control, new ideas and lots of models are all yours in a booming year for recreation vehicles

BY DAN FALES, Outdoors Editor

**F**IRST THING you'll spot in recreation vehicles this year is better workmanship. There's been a concerted effort within the industry for better quality control. Interiors are now being put together with an eye to smoothing out rough edges.

Workmanship has been a problem in the past—especially in the various types of conversions. When a van-maker finishes a vehicle, he turns it over to another company to add equipment to make it a camping van

**FORD'S NEW MINIHOME** is 123½-in.-wheelbase Econoline Super Van with camper conversion. Price: \$4800 as standard with 205-hp V8 engine







**STARCRAFT'S** new camper coach is arranged to allow additional interior space. Note the top and back design

**APACHE'S NEW SCOUT** is designed for the lower-priced market. This 7½-ft. tent trailer sells for \$495 plus freight. It has full, 7-ft. headroom when raised, and is 40 in. high when closed. Scout is the low end of the Apache line, which is topped by the 13-ft. Ramada for \$1675 plus freight



**COLEMAN'S NEW CT 360** is a 7-ft. tent trailer which opens to a width of 15 ft. 11 in. This four-sleeper sells for \$695 plus freight. Coleman's line runs from the CT 360 up through the 11-ft. hardtop camper trailer called CT 390 which has a galley, sleeps eight adults and sells for \$1665 plus freight



**NIMROD'S CAMELOT** is a hardtop camper trailer which shows company's new "tent" design with wide, screened openings. The Camelot is designed to let you equip your own interior. Standard are zip-in screen door, linoleum, under-coating, high-impact thermoplastic hardtop. At \$1269 plus freight, it's the middle-range Nimrod model







**WINNEBAGO'S** motor homes come in variety of sizes from the D-27 model to the F-17. Equipped as standard, the 27-ft. model goes for \$10,420 plus freight; the 17-ft. unit for \$5,705 plus freight. Winnebago has also announced a 22-ft. traveling man's motor home that he can custom fit. Company also makes travel trailers in sizes 17½ to 23 ft.



or the like. In some cases, the conversion results in rough and sharp edges where a roof has been "elephantized" or a window added. In some camper coaches, you would get splinters in your hands from rough-cut wood. Weatherstripping in many vehicles didn't do the job.

But now the producers are taking note of the complaints by cracking down on poor quality. You'll see the results this year. You'll also see model after model of a particular make. RV manufacturers are giving you almost as many choices this year as the automakers. Some RV companies are adding two or three low-priced models to their lines as well as new superluxury rigs. Others are not only adding at both ends, but expanding in the middle, to give you a rig for just what you want to pay.

It's true that prices on some makes are higher this year—perhaps \$100 or more on each unit. Many justify this increase by making some features standard instead of "extra."

On the other hand, it's also true that there's a definite trend to make spacious RVs that will sell for under \$5000. These rigs are aimed at the "second-car" market. Now you can buy a van, or pickup truck or four-wheel-drive vehicle designed as a rig for camping, but easily transformed to an alternate means of transportation around town.

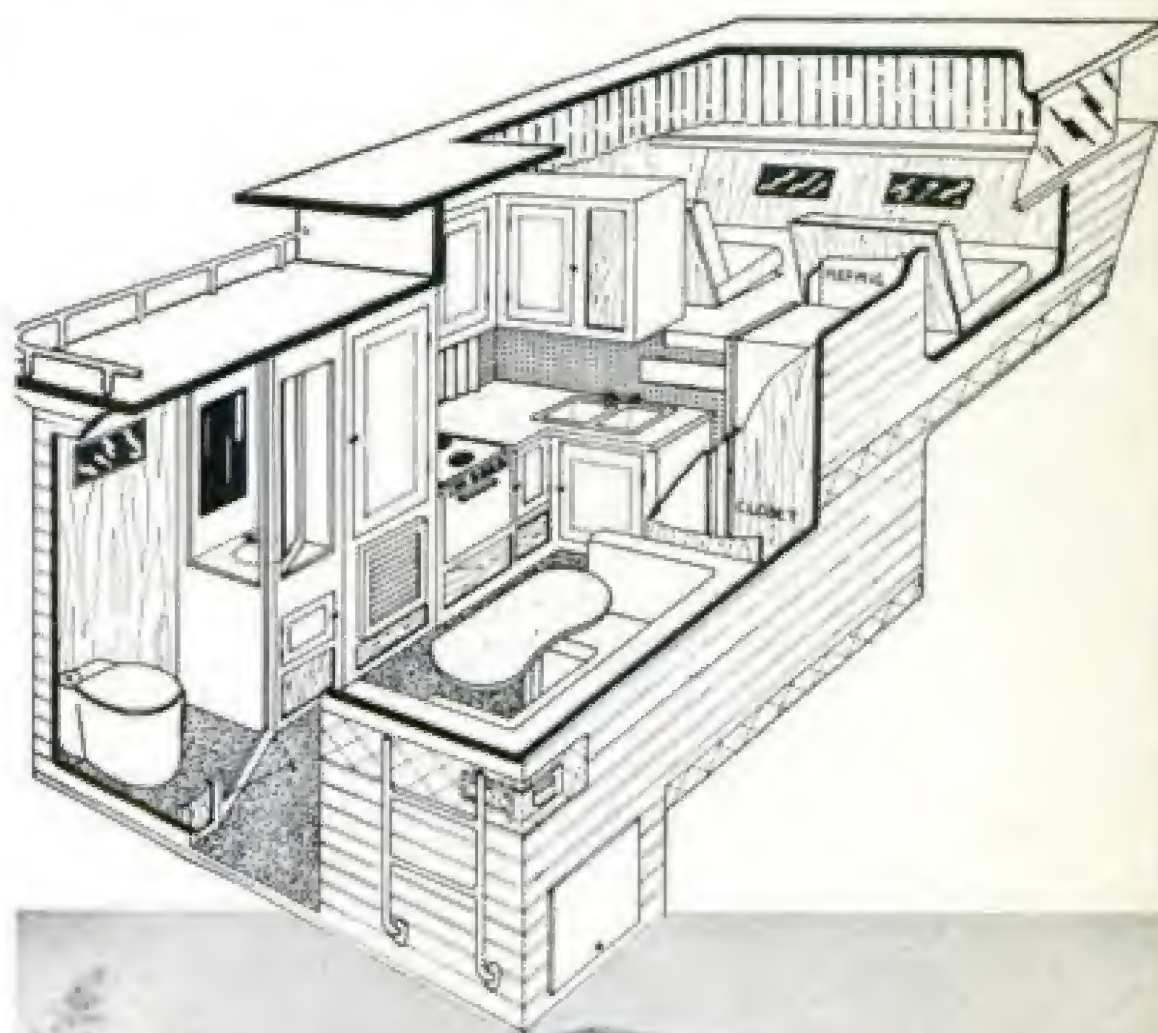
Another trend is one that hit full force last year—self-containment. This year, a new RV will let you travel almost anywhere without causing worry about facilities at stopping spots. There are better galleys in the '69 RVs; better, more permanent heads, and better decor, plus improved water pressure, heaters and a bit more space in which to move around.

The RV industry estimates that 500,000 units will be sold this year. Next year should do even better. The wheel-camping boom is really on. ★★★

MAY 1969



**SIESTA'S TELESCOPING CAB-OVER** is for the sleek Ranchera pickup. Roof of the unit is 6 ft. from ground in the lowered position, offers 6-ft. headroom when it's raised. A single hand crank is used to operate the roof



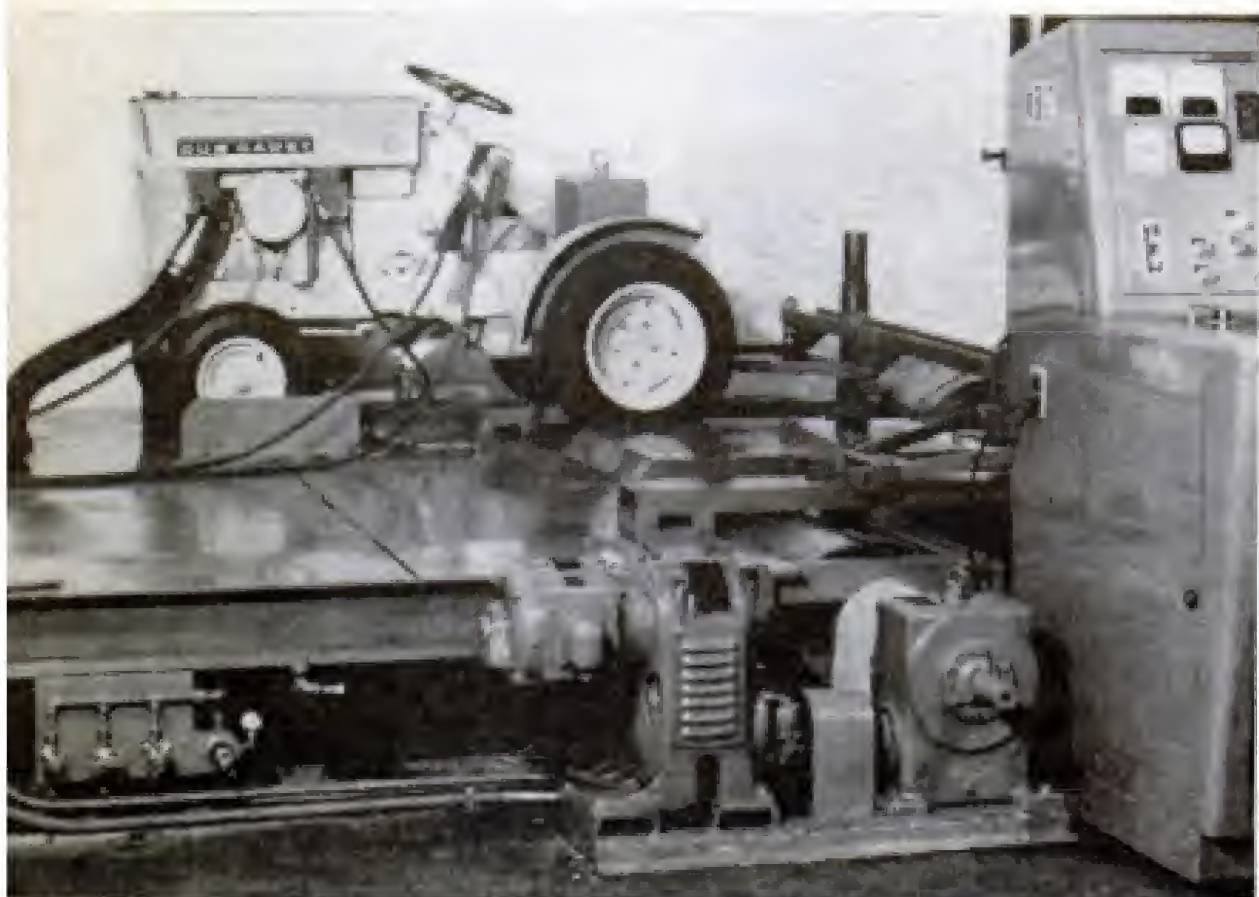
**DEL REY'S IMPERIAL SKYLounge** is a cab-over coach designed to match crew-cab pickup trucks. The Skylounge (photo above and cutaway) comes in three different interior layouts. It's planned for big-family use



# They're Awful Mean To Those Little Tractors!

By JAMES M. LISTON, Executive Editor

**TORTURE TRACK** used for large tractors is also used to test International Harvester Cadets. Treadmill, controlled from console (below), gives drawbar, cooling, temperature readings



**H**OW GOOD are today's garden tractors? They look rugged—but are they built to stand rugged use? Have the “bugs” been worked out of them? What about parts and service?

To get answers to these and other questions about the testing and development that goes into compact tractors, I traveled to seven states and interviewed 12 major manufacturers.

This comparatively new industry—it had its start in the late '50s—is highly competitive. Most makers who have survived are old-line companies

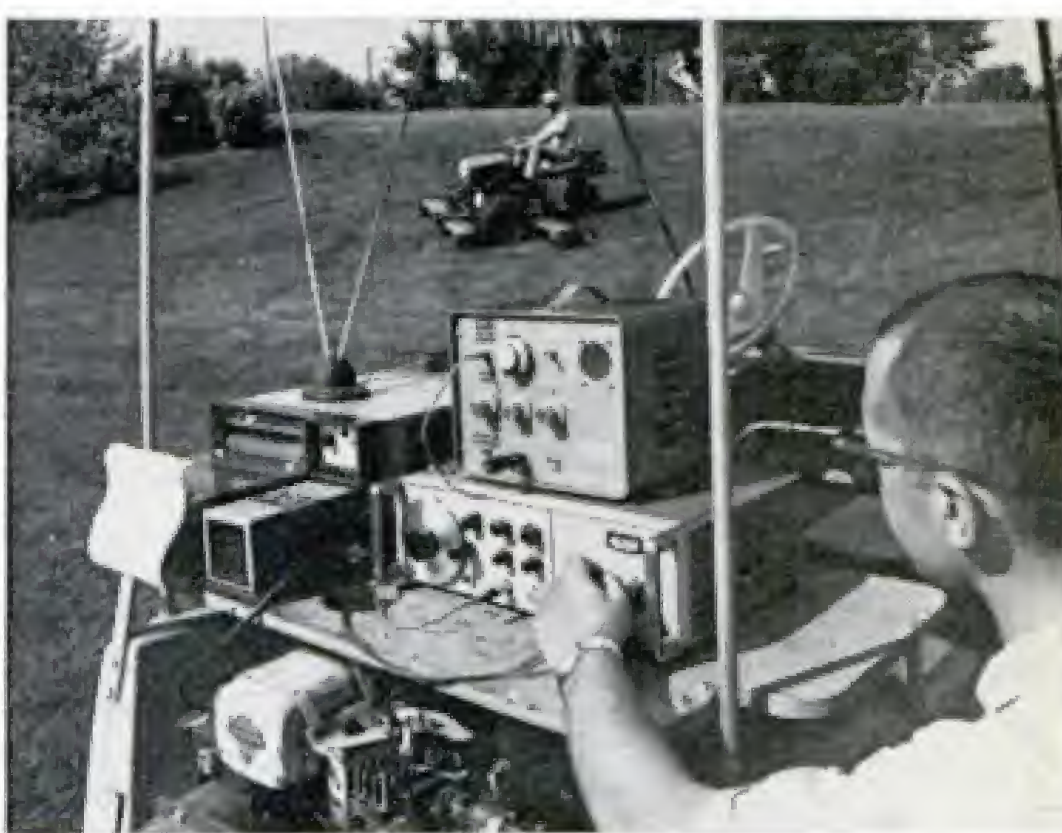




**ABANDONED RAILROAD SIDING** next to Case plant (left) is used to bump-test tractors. A Gravely 424 with standard mower chews its way through tall weeds in test of shock loads expected when customers mow overgrown vacant lots



**BOLENS'** chief engineer, Dave Phillips (left), checks new 7-hp hydrostatic after field test



**TELEMETRIC EQUIPMENT** is used in the field to check the horsepower rating under load of Toro tractors and mowers

that are jealously protecting reputations for quality. Most have highly sophisticated laboratory facilities, but all conduct field tests in which a tractor and its attachments are put through "torture tests" that far exceed the sort of use you'll give it.

Take the Gravely 424 we watched in West Virginia. It had over 300 hours recorded use on a rough pasture. The pasture had been plowed and was now three feet high in weeds. Ruts and high spots had been left that caused frequent scalping by the 50-inch mower and threw sudden, heavy shock loads on the belts. The test was to see if belts from a supplier were up to Gravely specs.

"A lot of our customers are commercial-maintenance people," said Cecil Brake, Gravely's merchandising manager. "If we don't test like this, our equipment won't measure up, and our reputation will be gone. You can't build something and take an engineer's word it will last, say, 500 hours. No matter how good the engineer, he'll never test the way a man will who's actually using it. The inexperienced guy will ram the throttle to it when an engineer would ease back."

"It takes the average owner three years to put 300 hours on his mower," said John Clark, vice-president, engineering. "When you compare an average lawn with this test plot, you can at





**TETHERED** with a cable, Deere tractor runs in circles day and night, quickly accumulating hours of use. Cart it tows contains test equipment and gasoline

least double that figure. If a machine can handle conditions like this, it will handle ordinary jobs without trouble.

"We're increasing our laboratory testing to be sure that we have the prototype of a new model as right as possible before we start field-testing. We then see what the new product can do under actual field conditions. We make changes, then start our pilot-model runs. When production starts, we pull random samples off the line and put them through their paces in the field. We work them to death. But if there are any bugs in them, we've determined through breakage whether the failure was caused by a



**ENDURANCE LIFE** of snowblower is tested by feeding the auger a damp mixture of sawdust and sand, and recirculating it. Spout is repeatedly swiveled

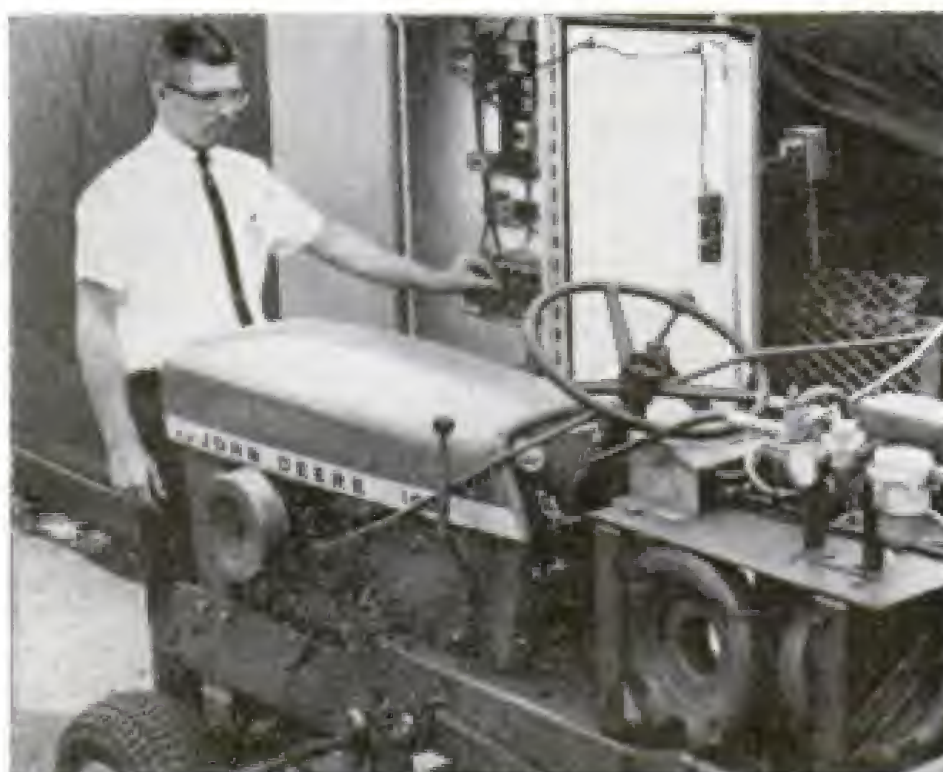
malfitting part or defective material and we correct it in production."

Rain was pelting the test track behind the John Deere engineering building at Horicon, Wis., but the driverless tractor, towing a trailer and fuel, continued to go around and around on a tether. It had been running at full throttle for days. Nearby, three other tractors on test stands roared into life, shifted gears, were run under load on a dynamometer, shut down, repeating the cycle endlessly. All were connected to a control panel by air lines, and the panel was set to cycle them 24 hours a day.

Vilho Mutka, test supervisor, had to



**LOAD TESTING** a Simplicity tractor; lead tractor must work against compression of towed unit. Instruments give drawbar and temperature readings. Control panel (right) is programmed to run Deere tractor on automated start, full load and stop cycle







**KARTING TRACK** near Wheelhorse plant offers ideal condition for scuff-testing tires. Concrete is preferred to turf because it gives quick test results



**LADY DRIVERS** are employed by Gilson to test tractors and mowers on the theory that if there is a wrong way to operate machinery, women will find it

shout to be heard: "When a failure is reported by our dealers, many hours of use must be piled up in a short time. Field tests are limited by an eight-hour shift, but when the proper tests are set up, we can run continuously until the problem is solved."

"Like the auto industry," says Deere division engineer Jack Hoffman, "we do have 'callbacks.' For years the farm-equipment industry has had 'field changeovers' or 'improvement campaigns.' When a chronic problem becomes apparent, a field kit is issued—particularly if safety is involved—and it is the responsibility of the branch houses and service organizations to see that every machine gets changed. We haven't received as much publicity as the auto industry, but our industry has done this many times. Every reputable manufacturer has a program for correcting problems that were not apparent in prototypes."

Wayne McClellan, service manager, points out that Deere is putting increased emphasis on engineering safety into the product. A four-man board checks prototypes in use for "knuckle-skinners, knee-knockers and upset hazards." The stability of the tractor gets intensive testing, as do seat design and standardization of controls. Test drivers' reports on fatigue include details on backache and legache. Tests determine how hard a woman can de-

press a clutch, how far she can reach for a lever, how much she can lift.

Gilson's field test crew at Plymouth, Wis., includes two female mower pilots on the theory that if there's a wrong way to operate machinery women will find it. A male driver accompanies the girls as they mow, but each must start the engine herself, refuel, and make all adjustments for mowing. If the lady drivers have trouble starting the engine, operating the controls, or experience unusual fatigue, Gilson engineers want to know it. Today, with more women mowing, the company believes that if it designs with them in mind the product will be simpler and safer.

Gilson's test crew occasionally mows the shoulders of a road bordering the plant. Here they find the toughest kind of going—steep embankments, ditches and high, tough grass. I checked their reports after several days of it and the crew proudly pointed to a failure they uncovered. Cracks had developed on two footrests. The cause was apparent: the metal had been bent on too tight a radius. Although the failure had developed after 300 hours (six years of average use) and was the first of its kind, the footrest will be redesigned.

At Port Washington, Wis., Simplicity, like other manufacturers, has found the small tractor is gaining wide acceptance by commercial groundkeepers

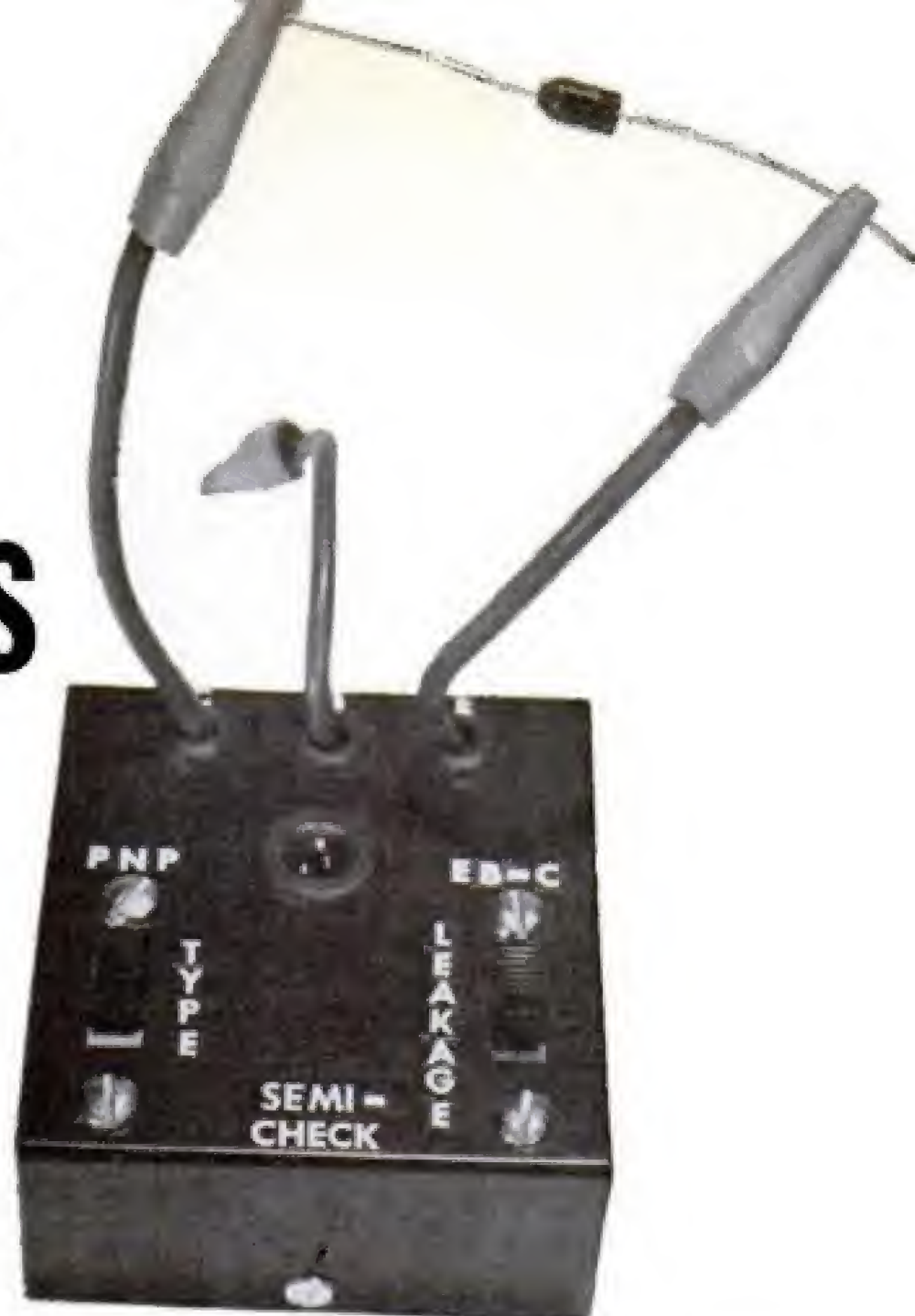
*(Please turn to page 200)*



# SIMPLE CHECKER FOR SEMICONDUCTORS

Want to know if a diode is good? Whether you've got the right transistor? This easy-to-make tester will tell you

By JAMES A. FRED



**M**ODERN SEMICONDUCTORS come in a variety of confusing types, often unmarked and untested. If you keep a junkbox full of unknown parts or like to browse for secondhand bargains, this handy checker for semiconductors—I call it a Semi-Check for short—will save you a lot of grief. It will detect opens and shorts in diodes and transistors, determine PNP and NPN polarity, test for leakage and check the triggering of SCRs.

Powered by two 5.4-volt Mallory mercury batteries, the device consists of a No. 49 2-volt test lamp and a double-pole, double-throw slide switch that reverses current polarity for determining transistor types. A single-pole switch lets you check for leakage between the emitter and collector with the base open or with the base connected to the emitter.

The E, B and C test leads terminate in small alligator clips. A 200-ohm variable resistor (Mallory MTC 22L4) is connected in series with the test lamp. Start with this in maximum clockwise position, then connect the C and E leads together. With a 0 to 10-volt d.c. voltmeter across the lamp bulb, adjust the resistor until you read 1.9 volts. This protects the 2-volt bulb from excessive voltage.

Everything fits into a tiny chassis box

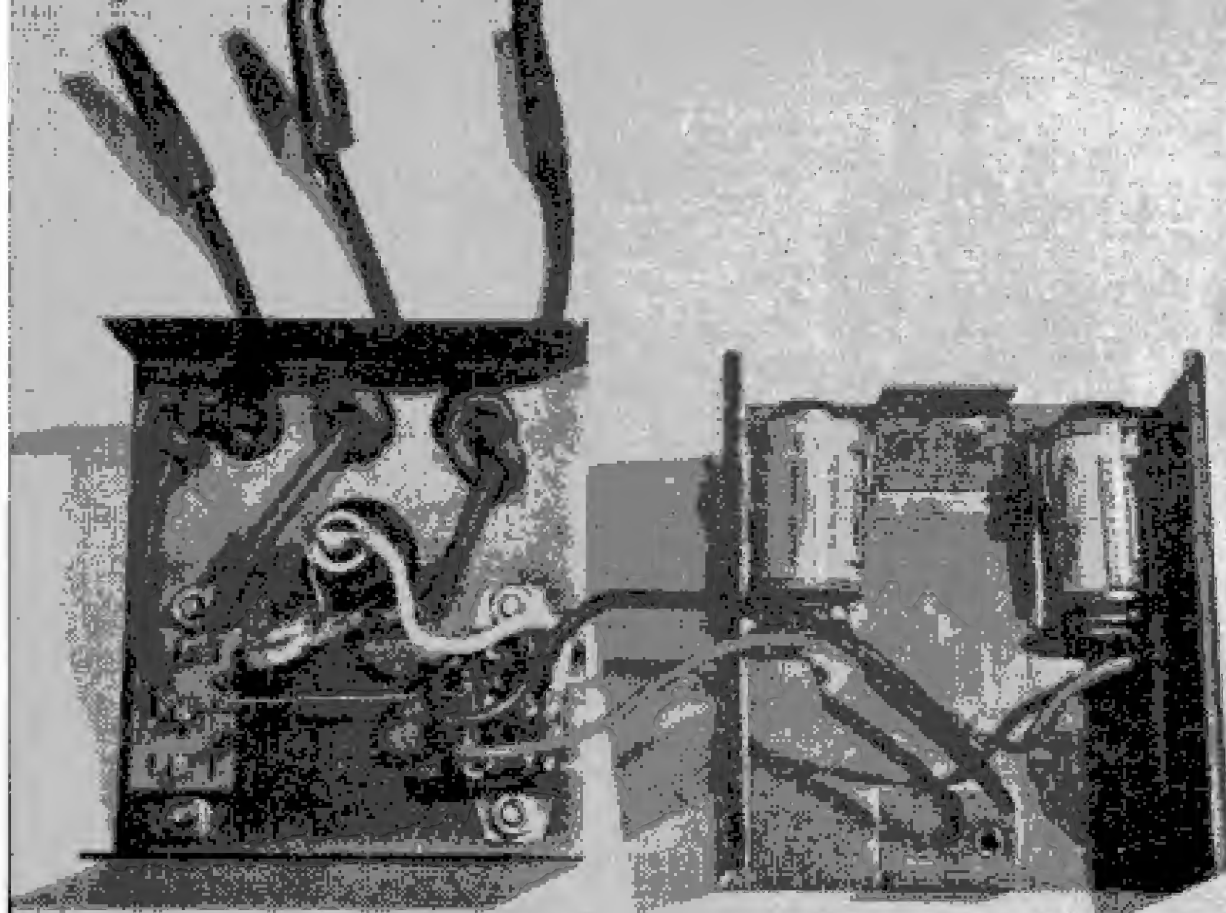
smaller than a pack of cigarettes. Use a rubber grommet to form a protective collar for the lamp. The parts are readily available at radio stores or electronics supply houses such as Allied Radio in Chicago and Lafayette Radio in Syosset, N.Y. Here's how you use the checker:

*To check a diode:* Connect the anode to the E clip and the cathode to the C clip. With the polarity switch in the PNP position, the lamp will light if the diode is good. With the switch in the NPN position, the lamp should not light. If the lamp lights in both positions, the diode is shorted. If it doesn't light in either position, the diode is open.

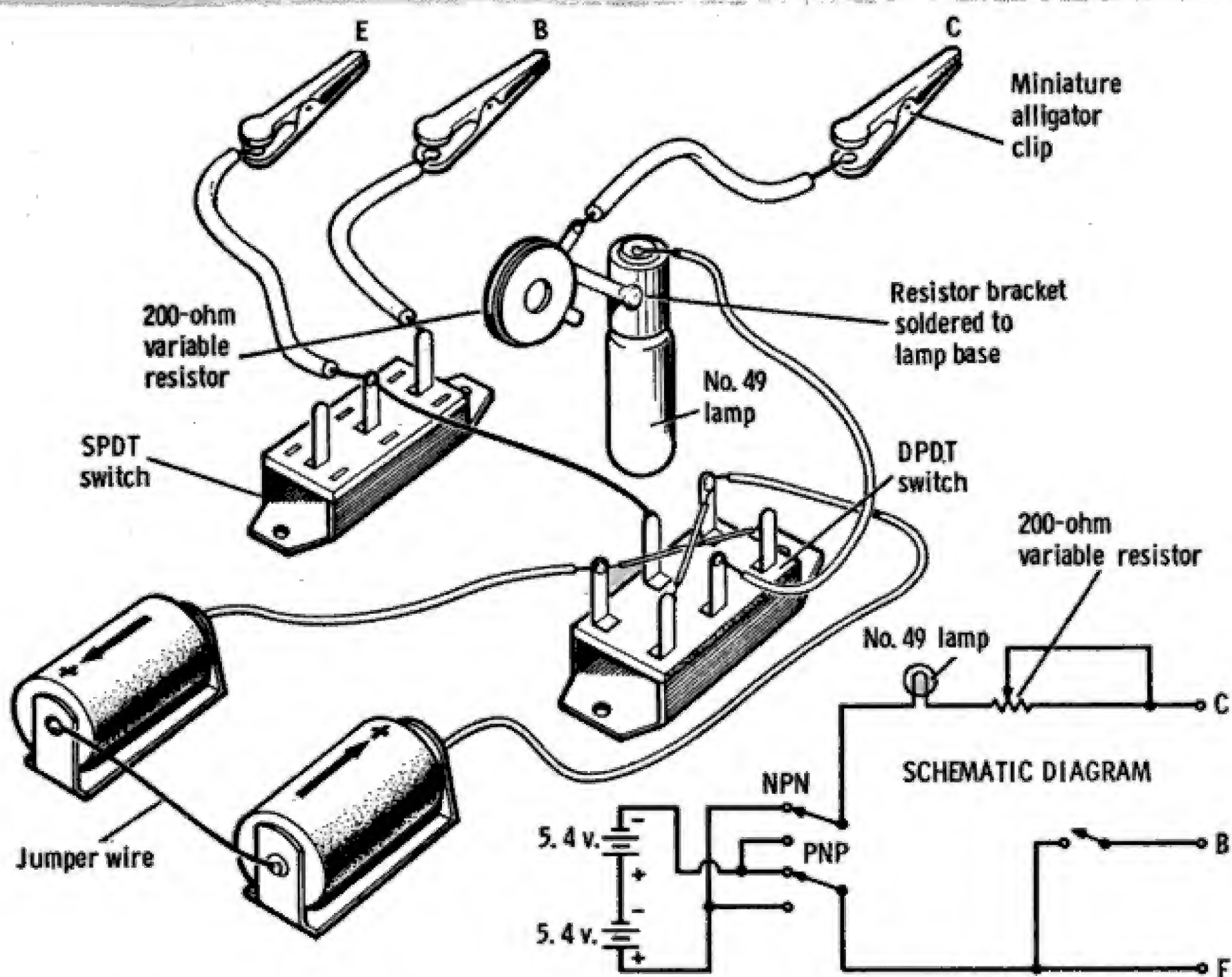
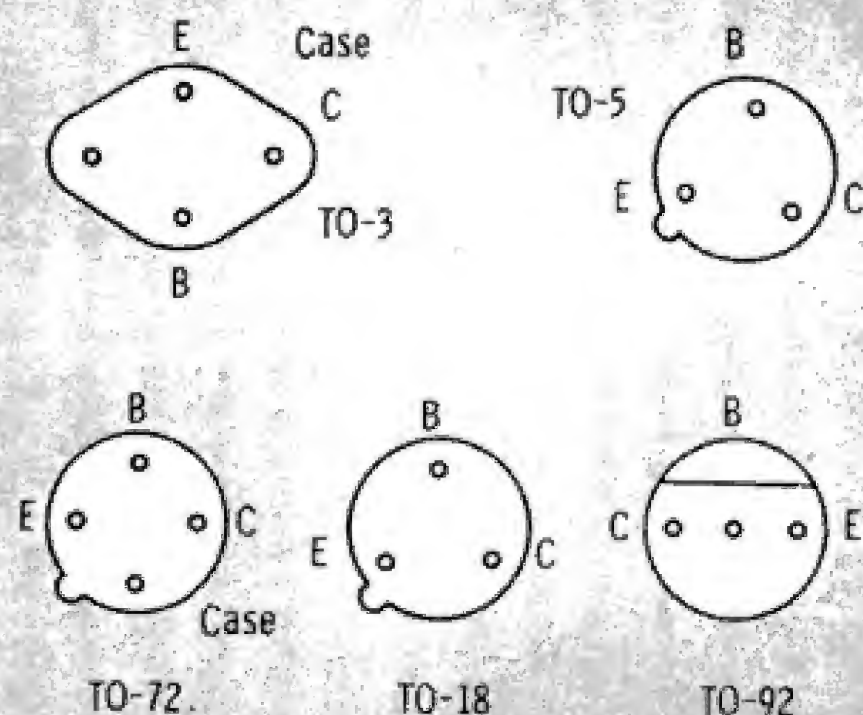
*To check an SCR:* Connect the anode to the E clip and the cathode to the C clip with the polarity switch at PNP. The lamp should not light until the gate is connected to the B clip with the other switch in the EB-C position. The lamp should stay lit until C is disconnected.

*To check a transistor:* First, determine the type—PNP or NPN. Connect the emitter, base and collector terminals to the corresponding E, B and C test clips. The accompanying diagrams show the terminal arrangements for five common transistors. Slide the polarity switch to the PNP position. If the bulb doesn't light, slide the switch to the NPN position;





# BASE DIAGRAMS OF COMMON TRANSISTORS



it should light in one position or the other. The position in which the bulb *doesn't* light indicates the type. If the bulb doesn't light in either position, the transistor is open. If it lights in both positions, the transistor is shorted.

Next, check for leakage. With the polarity switch set to indicate the type of transistor under test, slide the other switch away from the EB-C side. This checks leakage from C to E with the base open. The degree of light will indicate the amount of leakage. An ideal transistor

will show no light. Now slide the switch to the EB-C position. This connects the base to the emitter. Ideally, there should be no increase in light intensity. A power transistor will usually show leakage; a small signal transistor should show none.

One final caution: Be sure to install the batteries as indicated for proper polarity. Reversed polarity will cause the checker to give opposite indications from those described. If this should happen accidentally, reverse the batteries before continuing.

★ ★ ★



# Dry-Mount Your Favorite Photos For Display

Simple adhesive tissue you iron on, some white mounting board and a dramatic black backdrop make a slick way to show off prized pictures

By BOB CORLEY

**I**T'S AMAZING what some plain white mounting board and a contrasting backdrop will do for photographic blow-ups. By displaying your best shots on a background panel, you can create a striking wall decoration for a living room or playroom and at the same time enjoy pictures that otherwise get stored away in a bureau drawer for no one to see.

You don't need an expensive mounting

**MOUNTING MATERIALS ARE SIMPLE.** All you need is dry-mount tissue, white mounting board, a razor blade or scissors and your wife's pressing iron. Prints look best with borders trimmed off flush

press, either. The secret lies in readily available dry-mount tissue. This is a special adhesive sheet that, when heated, melts and bonds a print smoothly and firmly to mounting board. The tissue is sold at photo shops and artists' supply stores in several sizes.

Mounting board is a heavy white cardboard, also available in various sizes at photo and artists' shops. For 8x10 prints,

**LAY MOUNTING TISSUE** over back of print and touch the center briefly with tip of iron. This tacks tissue in place temporarily. Trim off the excess tissue at edges with a razor blade or scissors







it's usually best to use an 11x14 mounting board. This creates an attractive border effect and makes your prints look larger, as well as providing a smooth, stiff protective backing.

All you need to mount a print is a pressing iron. The dry-mount tissue is slipped between the print and the mounting board and the sandwich ironed until the adhesive melts and forms a tough,

**PLACE PRINT FACE UP** on mounting board so that the tissue is in between. When it's properly positioned, gently lift each corner, one at a time, and tack the tissue to mounting board with iron's tip

permanent bond. To help you position the print accurately, the accompanying photos show how the tissue can be temporarily tacked in place. This keeps the parts from slipping during the ironing.

The final ironing is done over the face of the print, but not directly on it. Place down a piece of heavy brown wrapping paper or a manila envelope and iron over this to protect the print. Set the iron on

**COVER PRINT** with heavy paper and run iron over entire area until tissue thoroughly bonds both together. Do half of print at a time, working the iron from center outward to be sure of smooth results







**MOUNTED PHOTOS** are covered with glass and held in simple L-type screw hooks—two at the bottom and one at top. This eliminates the need for frames and makes it easy to change pictures from time to time

moderate heat—too much may damage the print or cause the adhesive to over-melt and not stick.

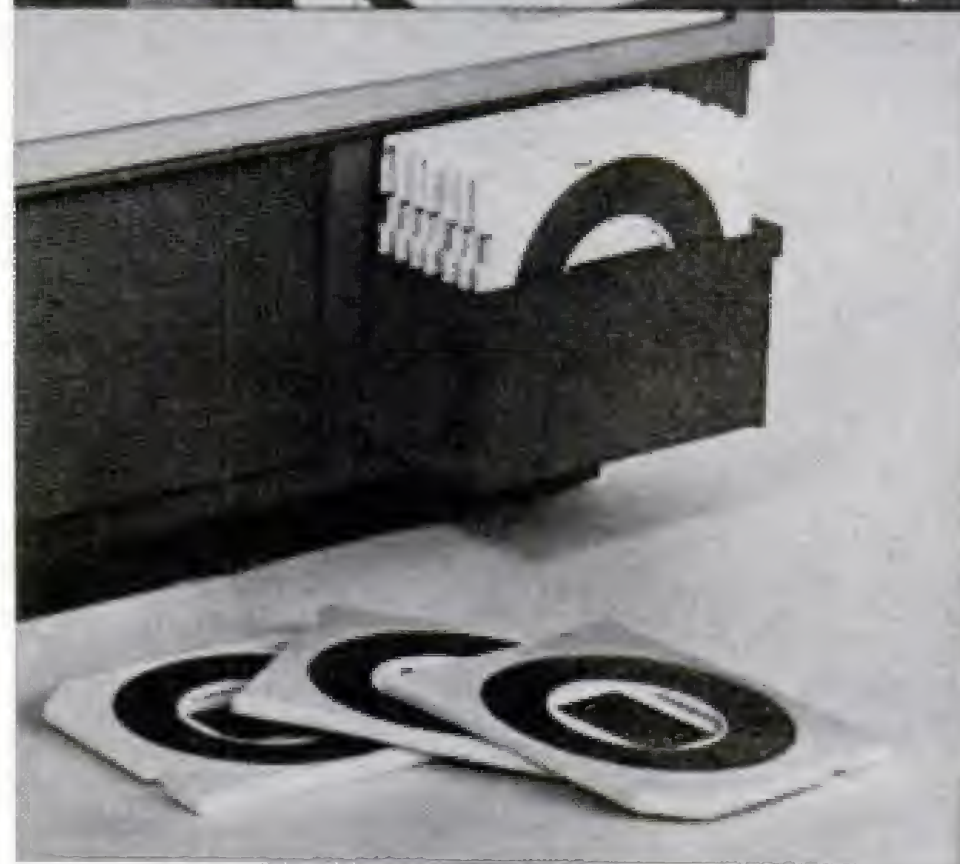
An eye-catching display panel for your mounted prints can easily be made by covering a piece of  $\frac{1}{4}$ -inch hardboard or similar material with a coarse, textured fabric. Black corduroy was used for the panel shown here. A 2x4-foot panel is just right for displaying three 8x10 prints on 11x14 mounting board.

Inexpensive window glass can be cut to fit over your pictures by a glazier or hardware store. The glass and pictures are held on the display panel by small L-type screw hooks that appear almost invisible at a distance. The panel itself can be mounted on a wall with a couple of heavy-duty picture hangers or wood screws in wall anchors. ★★★



**TO MAKE DISPLAY PANEL**, cover a piece of hardboard or similar material with fabric. Cut fabric slightly larger than the board all around, fold over the edges and tack or staple them to the back

# NEW IN



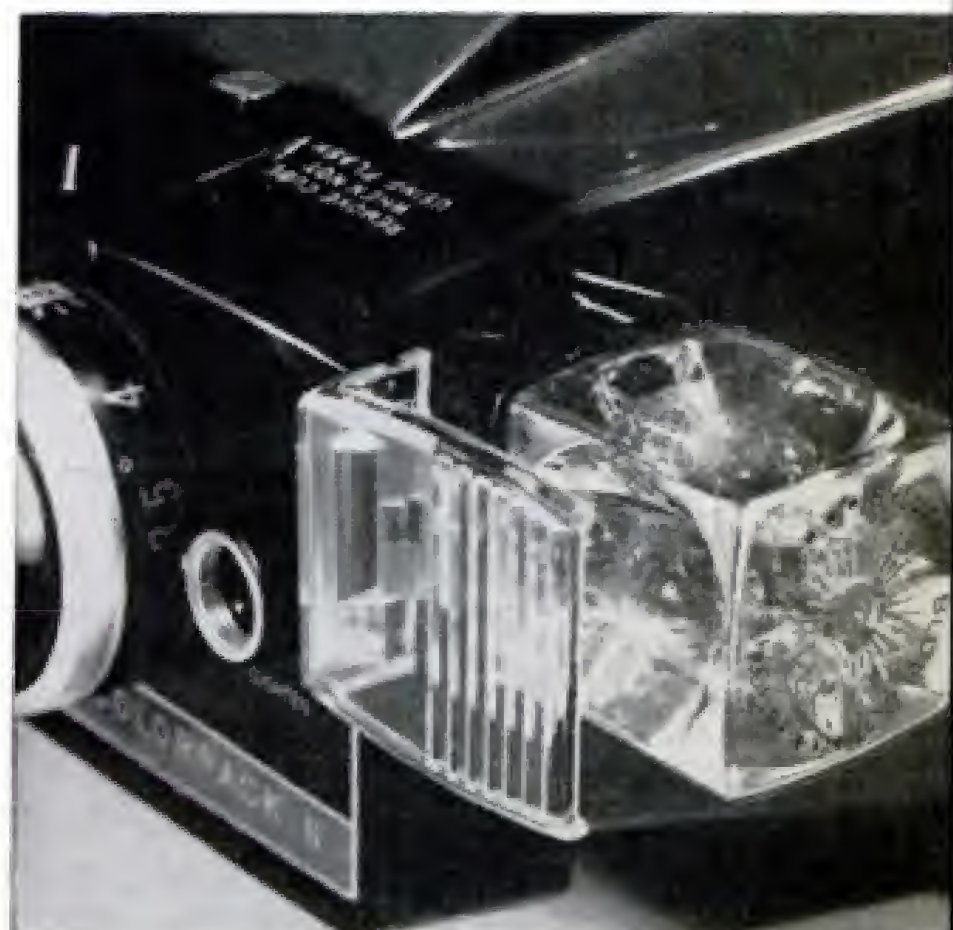
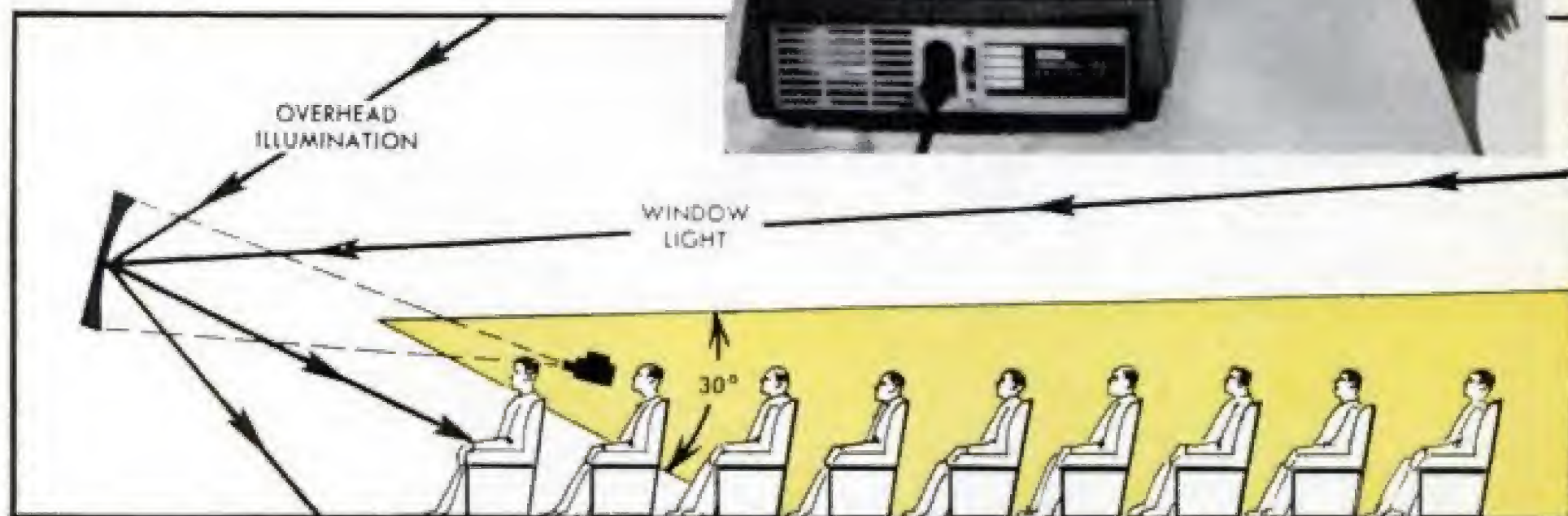
**LIKE TO ADD SOUND** to your slides? You can do it right on the slides with this combined projector-recorder by 3M. Each slide holder has a circular magnetic sound track running around the slide. You just project a slide and talk into a microphone to add your commentary. When the slide is shown again later, its sound track plays back automatically for your audience to hear. Each slide takes up to 35 seconds of commentary. The sound tracks can be erased and rerecorded or replaced with new ones. The machine, priced at \$645, is designed mainly for business and educational uses. A home version may come later.

POPULAR MECHANICS



# PHOTOGRAPHY

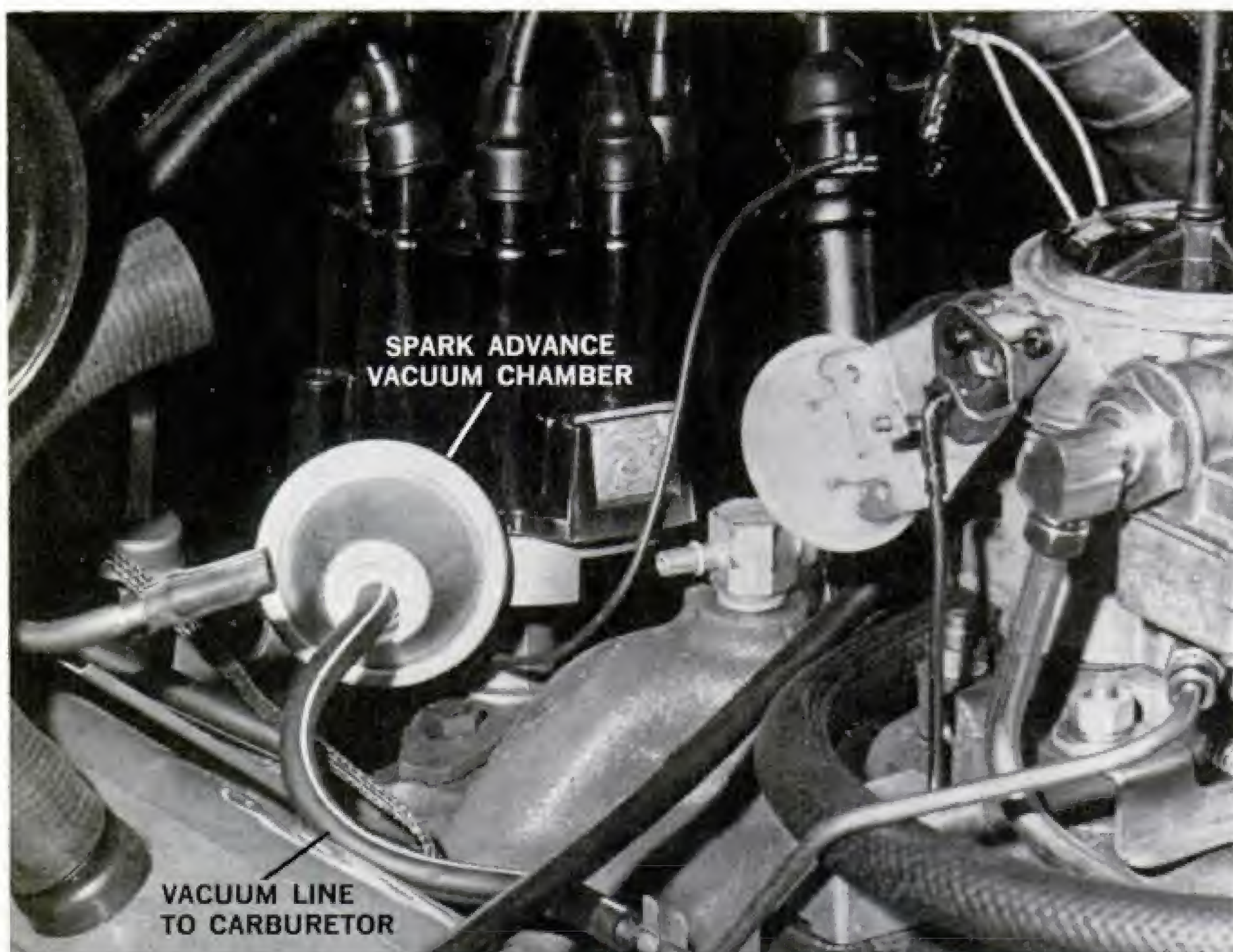
**YOU CAN VIEW SLIDES** and movies in a brightly lighted room with this new projection screen developed by Kodak—there's no need to pull down shades or switch off lamps. Slightly curved, the screen funnels light from the projector back toward viewers in a narrow cone, instead of dispersing it as flat screens do. It also reflects stray window and overhead light out of viewing range, keeping the image sharp and intense. Photo at right shows how an image appears on the new screen in bright light, but not on a piece of ordinary screen held in front. Ektalite screen, of aluminum foil backed by fiberglass, is available in a 40 by 40-inch size for \$65.



**NEWEST INSTANT-PRINT CAMERA** is the Polaroid Colorpack II above—the first model to take color for under \$30. One of a new line of cameras, it's also the first to incorporate a socket for flash cubes. Now all you do is flip open a hinged plastic shield, plug in a cube and shoot. The cube rotates automatically as each shot is made, ready for the next. The camera has a self-adjusting electric-eye exposure system and takes black-and-white film packs as well as color.



# How to Check Distributor



Old-timers had to advance and retard ignition spark by hand while driving; on your car it's automatic, as long as the vacuum unit is doing its job

**D**ISTRIBUTOR VACUUM ADVANCE is variously known as vacuum advance, distributor advance, distributor spark control, automatic spark advance, distributor vacuum advance, and advance timing mechanism. Another term using the word "retard" would also be appropriate—because once the spark advance unit advances the spark, it must eventually retard the spark from the advance position.

Advance means that the spark occurs earlier than specified ignition timing, and retard means that the spark occurs later. Each term refers to the point of piston

travel at which the spark occurs to ignite the fuel mixture in the cylinders.

If the spark advance unit fails to function, your engine will act sluggish and fuel economy will suffer. These symptoms should cause you to check the advance unit, although very often it is overlooked during troubleshooting. Knowing how the unit works is the best way to appreciate its importance in engine operation.

If you operated your car at the same speed and always on a straight, flat road, the distributor's job would be relatively simple. It would just have to deliver a pulse to each sparkplug at the same time



# Vacuum Advance

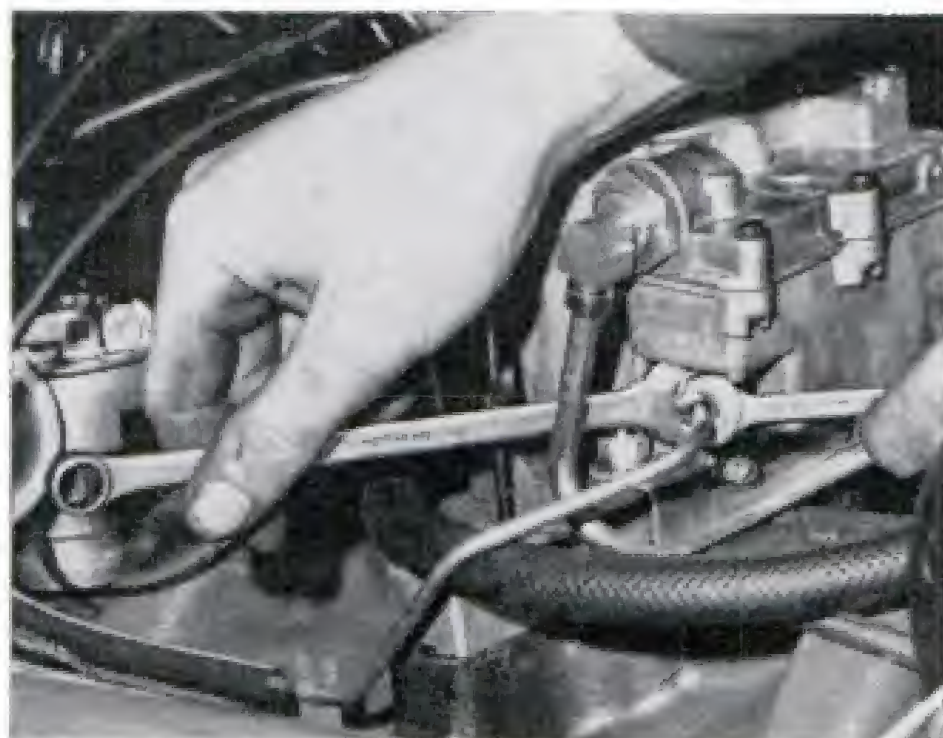
By MORT SCHULTZ



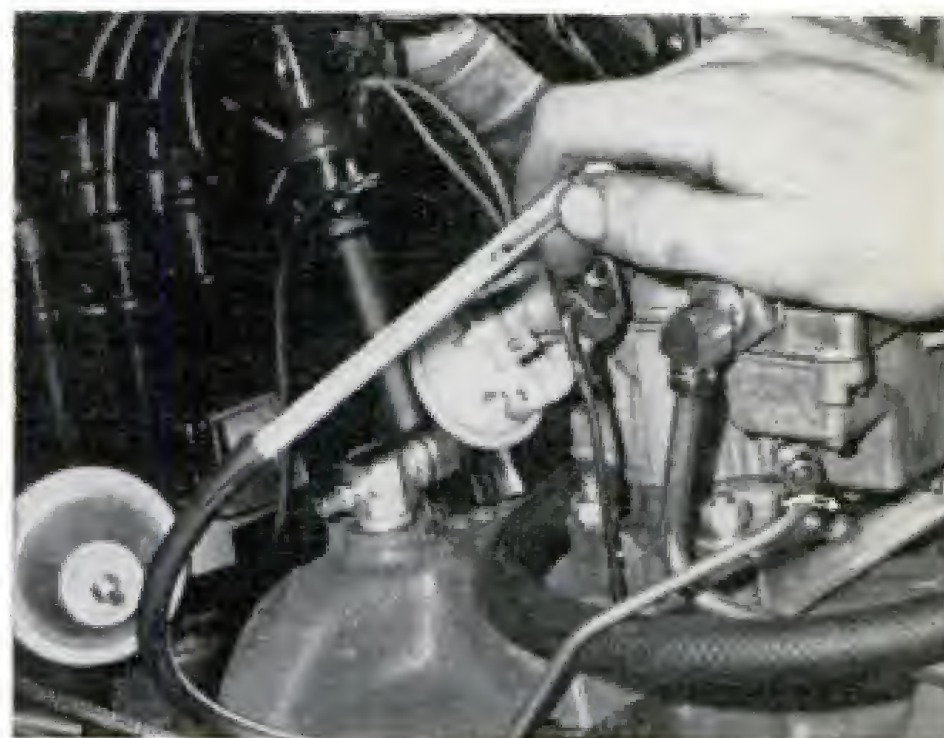
**CENTRIFUGAL ADVANCE** consisting of weights and springs is located above or below the breaker plate



**CHECKING FOR VACUUM** at spark advance unit is done by removing the hose and feeling for suction



**VACUUM HOSE** that is damaged or clogged can be removed and replaced. Disconnect from carb fitting



**PLUG VACUUM HOSE** with any improvised plug when specs call for timing ignition without advance

every time the piston reached a predetermined spot in its compression stroke.

But you don't drive that way. Your engine must operate alternately with and without a load on it, and at varying speeds. As speed and load vary, the time when the spark occurs to ignite the fuel mixture must also change—for two good reasons.

First, as speed varies, each piston travels at a slower or faster rate, and the fuel in the cylinders has more or less time to burn, respectively.

Second, as engine load varies, each cylinder receives a richer or leaner fuel

mixture that requires less or more time to burn, respectively.

The spark advance unit does *not* control the timing of the spark with engine speed. This is the job of another unit in your car's control center called the centrifugal advance.

The centrifugal advance consists of two counterweights inside the distributor which are joined together by two small springs. They are positioned to move in relation to distributor rotation. In other words, as engine rpm increases, the distributor shaft moves faster and faster. This spins the counterweights around, al-



lowing them to overcome the tension of the springs and move outward.

As they move, the counterweights activate the distributor cam assembly, allowing the cam lobes to open and close the distributor breaker points earlier in the piston's compression stroke. This advances the spark to give fuel the time it needs to ignite and burn completely before the piston starts on its power stroke. In that way, the maximum use of the fuel's full energy is made to drive the engine.

So much for advancing the spark with engine speed. When engine load varies, the vacuum unit must be ready to do its job. A rich fuel mixture requires less time to burn than a lean mixture. When the engine's put under an increased load, you are packing a richer fuel mixture into the cylinders, by depressing the accelerator pedal.

Conversely, when the engine is under a light or no load, the fuel mixture is leaner—16 to 1 or 17 to 1 as compared to a 12 to 1 or 13 to 1 ratio when the engine's under load. Since this lean fuel mixture takes more time to burn, spark has to occur earlier in the compression stroke to allow full burning.

Happily, engine vacuum varies with engine load and can be utilized to change timing automatically. As load varies and you press down or let up on the accelerator, you open or close the carburetor throttle plate which causes the intake manifold vacuum to change.

The spark advance unit is nothing more than a chamber in which vacuum is created. Inside is a diaphragm and a diaphragm spring. One side of the unit is connected by a vacuum hose to the carburetor—the other side is linked to the distributor breaker plate.

When there's little load on the engine, manifold vacuum is high (the carburetor throttle plate is partially closed, which creates more vacuum). This vacuum is strong enough to allow the diaphragm to overcome the tension of the spring. This moves the linkage to rotate the distributor breaker plate, causing distributor points to open earlier in the compression stroke. The spark is advanced and full burning of the leaner fuel is accomplished to give the piston maximum power on the power stroke.

When there's a heavy load on the en-



**TIMING LIGHT** is aimed at timing mark on pulley; if adjustment is necessary, turn distributor body to advance or retard the ignition timing (see text)



**ROTOR CONTACT POSITION** should be noted before removing distributor so drive gear on the shaft meshes with the camshaft gear when unit is replaced

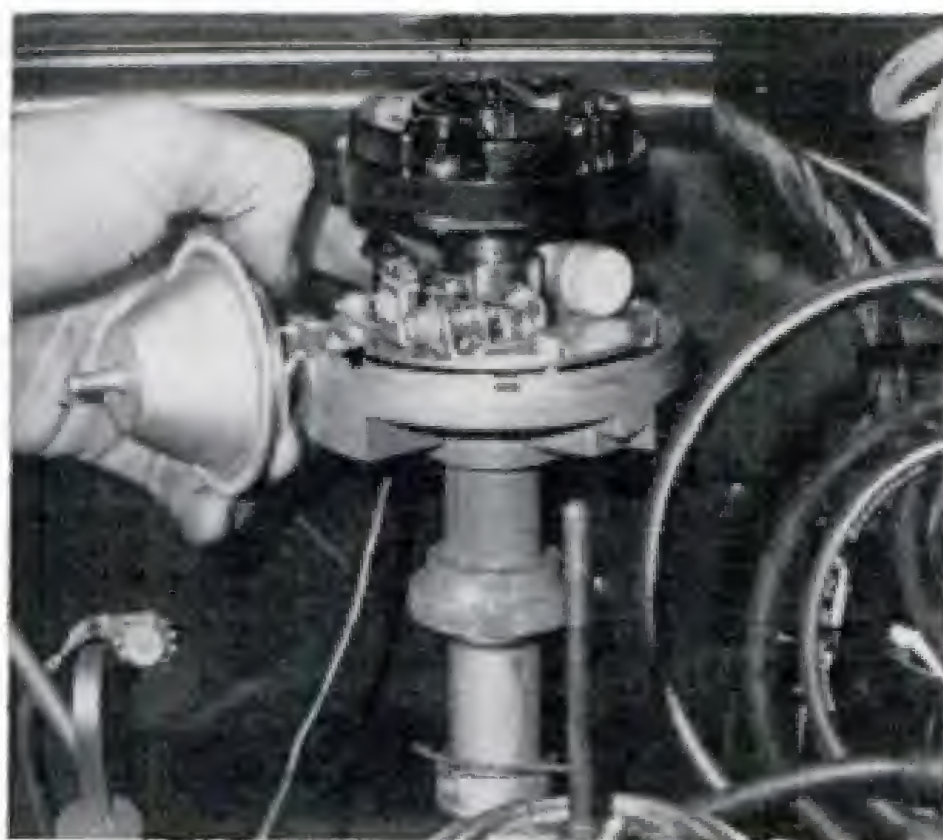


**A REMINDER** of distributor rotor contact position can be made by scribing a mark on an adjacent surface. It saves a lot of twisting and turning later





**SPECIAL WRENCH** with long shank is inexpensive (about \$3) and will make it a lot easier for you to reach the distributor hold-down bolt on the block



**TO REMOVE DISTRIBUTOR** from the engine, twist to free from cam gear and pull up carefully, keeping the shaft lined up with the hole in the engine block



**FAULTY VACUUM ADVANCE UNIT** is easily removed from distributor body after body is taken off engine. Replace only with a new unit specified for your car

gine, manifold vacuum is low (the carburetor throttle plate is open). This allows spring tension to govern control of the distributor breaker plate, which is now kept in retard position to cause the breaker points to open later in the compression stroke.

There isn't too much that can go wrong with the spark advance unit other than rupture of the diaphragm, which will cause the spark to occur late under all engine load conditions. This will cut down on engine power and result in a waste of fuel since not all the fuel will be burned under lighter load conditions.

It's possible, but not likely, for the vacuum hose to get plugged or develop a kink. To find out, start the engine, pull the hose from the spark advance and flick your finger back and forth over the opening. If you feel suction, there's nothing wrong with the hose. If there is no suction, disconnect the hose at the carburetor and replace it.

How can you tell if there's something wrong with the spark advance unit? There are three ways: by "feel," by using a stroboscopic timing light, and by using a distributorscope. Since you're not likely to have a scope, we'll forget about that. If you don't have a timing light, either, you might be able to tell if the spark advance is working by jockeying the vacuum hose off and on the nipple where the hose attaches to the unit with the engine running. If the unit's working, you may hear the diaphragm as it pulsates with a *thump, thump* sound.

Of course, the best way to check on spark advance is through the use of a timing light. The first thing to do, though, is to make sure the engine's timed according to spec.

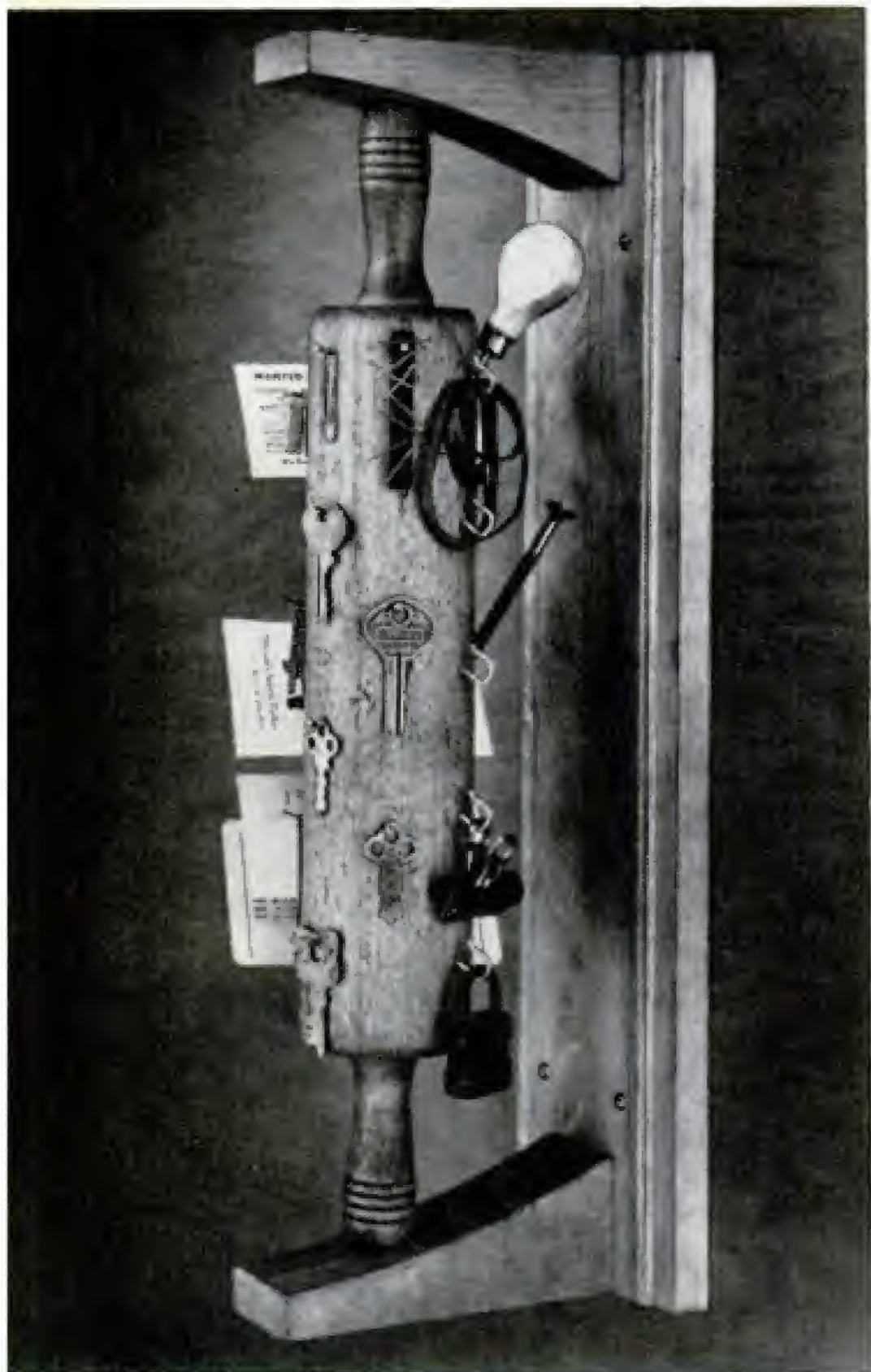
With most cars you have to disconnect the vacuum line from the spark advance before you can time the ignition. The line has to be plugged in order to prevent a vacuum loss which will cause the engine to idle roughly while timing is performed.

To time the engine, hook the timing light to No. 1 sparkplug terminal and start the engine. Aim the timing light at the timing mark on the crankshaft pulley. Look straight down the beam to the timing mark and pointer. If timing is accurately set, the timed pulses of the light

*(Please turn to page 216)*



# Weekend Projects



## Rolling-Pin Catchall

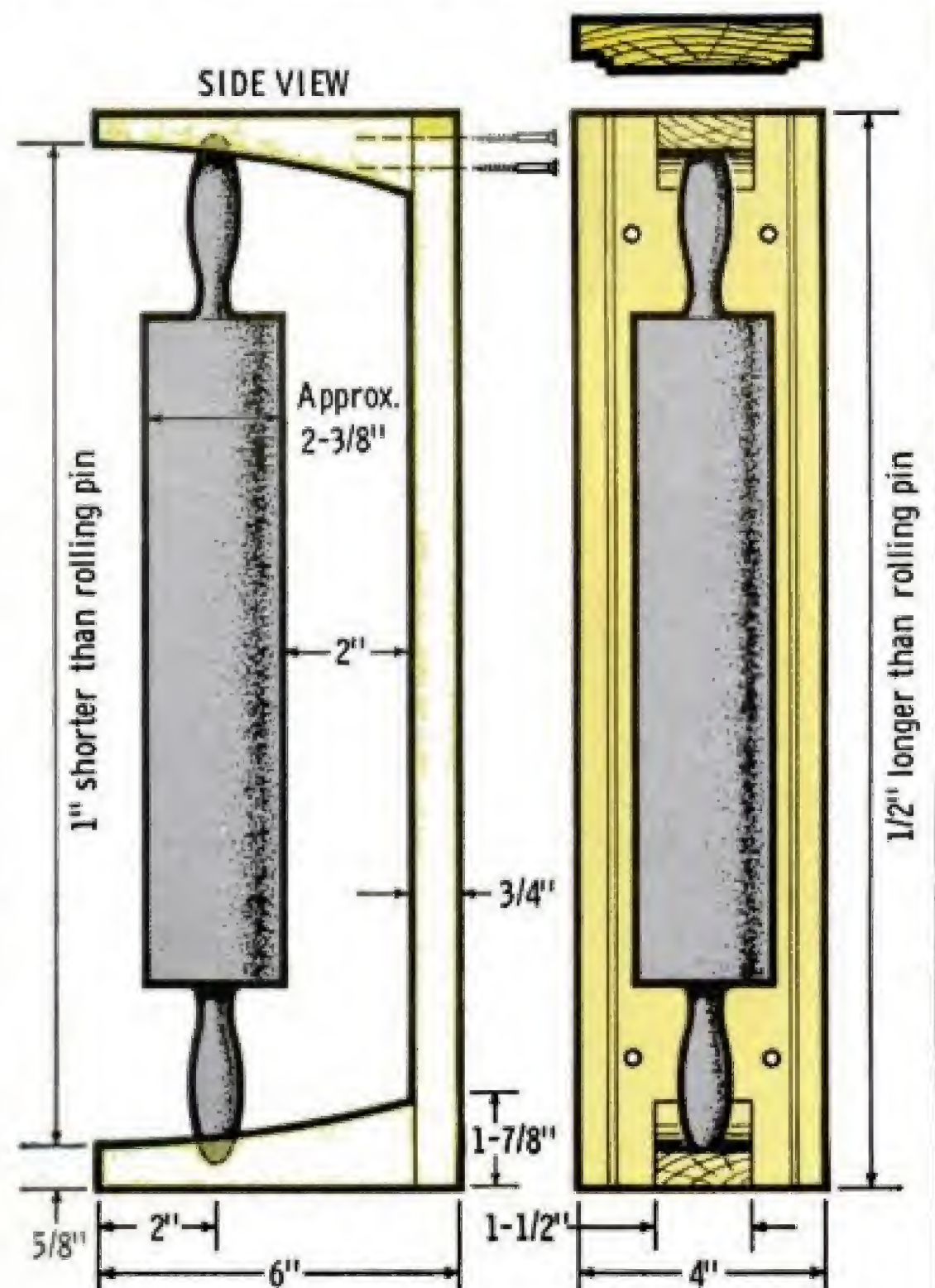
AT HOME in a kitchen or dining room, this spinning catchall is easily made from a wooden rolling pin. Often you can obtain slightly used rolling pins at a flea market sale or a used-merchandise store for as little as a dime each (that was the cost of the one illustrated).

The tips of the rolling-pin handles rest in cup-shaped recesses cut in two wooden arms extending from a  $\frac{3}{4}$ -in. back panel. The panel usually is mounted on a wall with roundhead screws but, if provided with a sufficiently heavy base, it also could be used on a table or desk.

The two arms can be made by gluing together two pieces of  $\frac{3}{4}$ -in. stock. The cup-like recesses for the rolling-pin handles are about  $\frac{1}{2}$ -in. deep and are made by first boring a hole with a regular bit, then reaming, filing or carving the resulting recess to shape.—Walter E. Burton



FINE SAW KERFS will hold messages, business cards and other reminders. Cup hooks keep keys handy



POPULAR MECHANICS



# You Can Build

Technical Art by John Lind

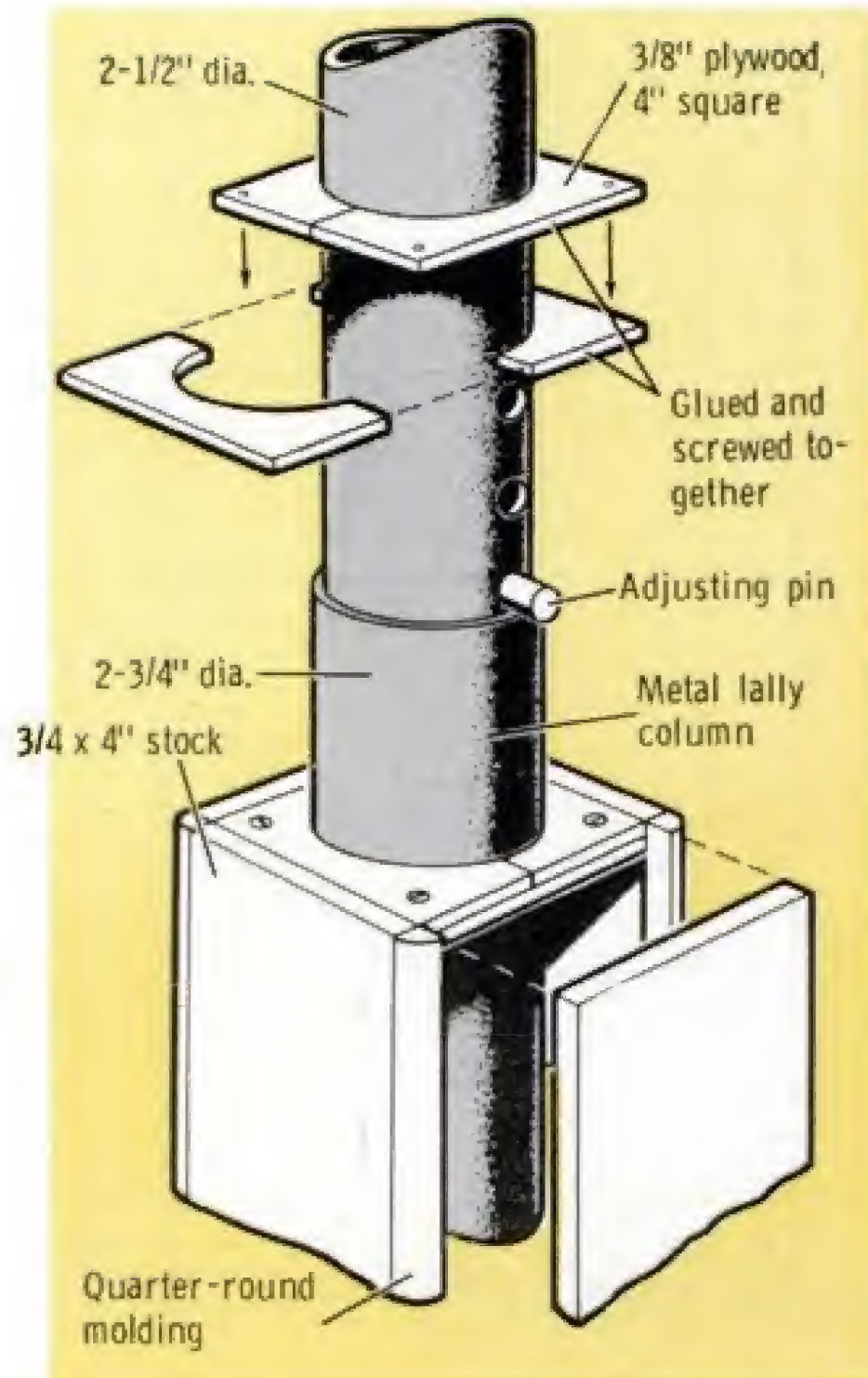
## Living With Lally Columns

IF UNATTRACTIVE lally columns or jack posts mar the basement you'd like to turn into a big, roomy recreation area, you can use these ideas to disguise the necessary evils.

In the case of a jack post, remove the rod (at the top of the post) that normally is used to turn the screw. This is no longer necessary since the posts are jacked up to their required height.

Next, measure the posts at the widest point where the pin goes through the center to support the top section, then measure the diameter of the post itself. It then becomes a matter of cutting spacers, as shown in the drawing below, to clear the widest point and provide nailing when the post is to be used to support a paneled partition.

Another solution to the problem is to build a square bench around the bottom



of the boxed-in post and add a wall lamp on one side. The wiring for the lamp, of course, must be put in before the post is completely finished.

Finally, fit colorful cushions on the square bench, which, incidentally, can be built as four triangles held together with small hooks at the back so as to gain added storage space beneath the bench.

—M. Sheppard





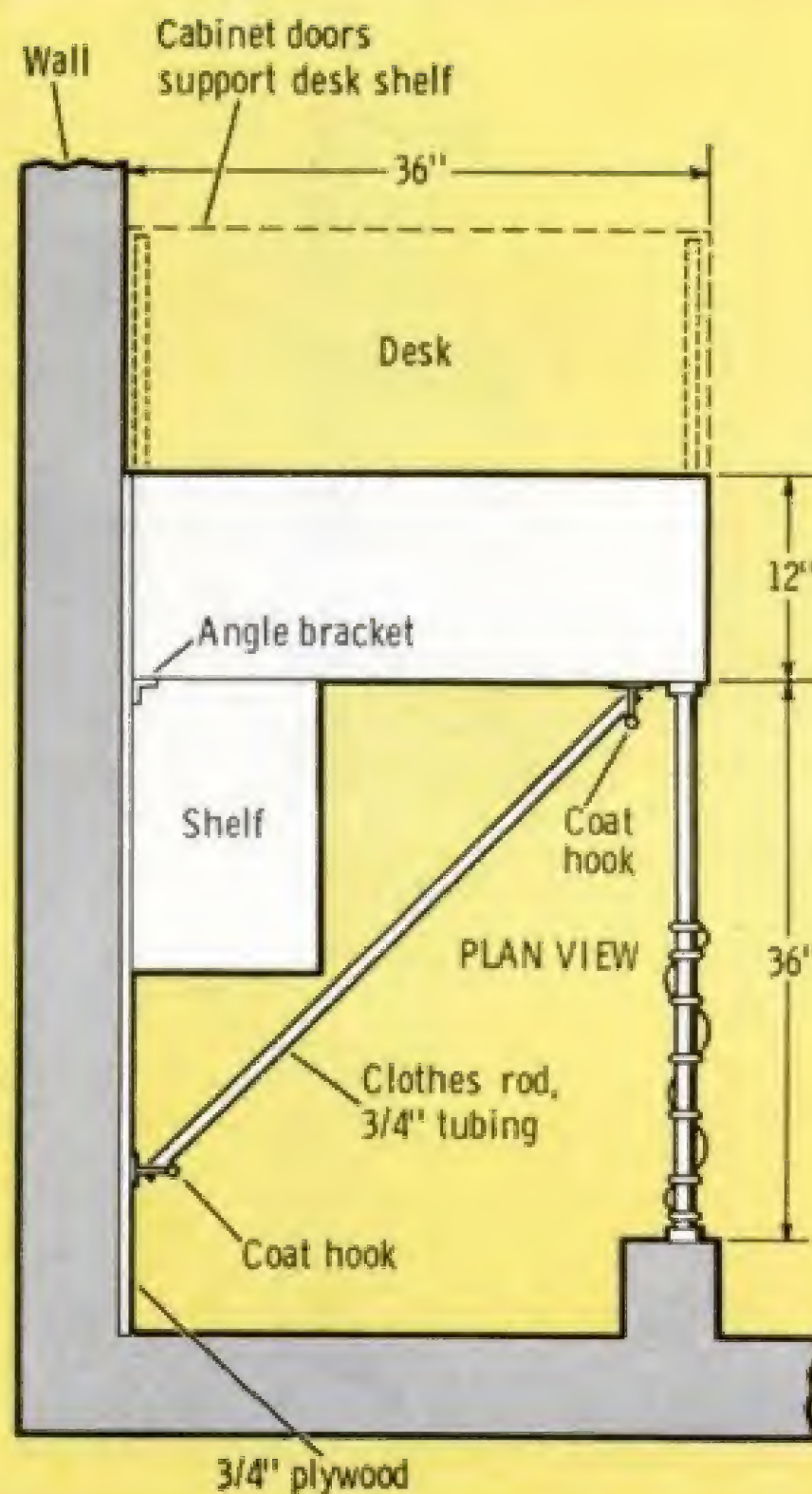
**BUILT IN A CORNER**, the bookcase closet takes little space, yet provides shelves, hidden storage

## Walk-In Bookcase Closet

IF YOUR LIVING AREA seems to shrink before your eyes, it's no illusion—you've just become short of storage space. This is especially true if you're renting an apartment, since your rental contract likely prevents you from making any permanent changes.

A novel solution to such a storage shortage is this free-standing, combination walk-in bookcase closet which fits in a corner. Construction is easier than it looks, and although the unit takes up only 9 sq. ft. of floor space and costs under \$20 to build, it can store quite a few items of clothing and several hundred volumes from your library.

What's more, you can increase its portability by fitting small casters on the bottom. With these, you could move it from wall to wall or from room to room depending on your need.—*James Plake*







## Baby Bathing Center

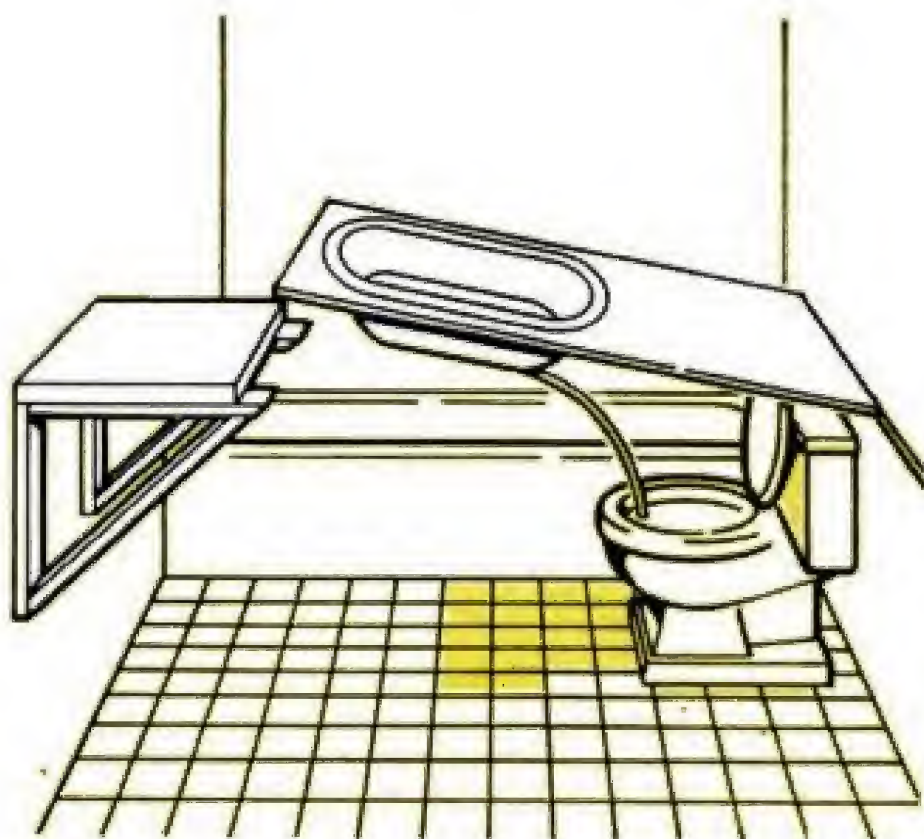
WITH JUST A BIT of thoughtful planning, you should be able to adapt this built-in bathinette to fit most any bathroom.

As shown in the photos, this infant's bathing center consists of a small plastic tub that's been securely fitted in a sturdy fold-down panel. The bottom of the tub, of course, is drilled for a drain hose that's opened by using a press-to-open clip like the one photographers use for chemical-dispensing hoses.

The water sprayer, on the other hand, is normally found on the newer types of kitchen sinks and can be hooked up to a wash-basin faucet without too much trouble. Thus, Mom can gently spray the baby with clean water before drying, and then she can easily drain the water into the toilet by pressing the drain clip.—*James Pickerell*



**STURDY FOLDING BRACKETS** must be used for short table-like support, could be permanently-installed, right-angle brackets if space allows







## Sandbox and Play Table

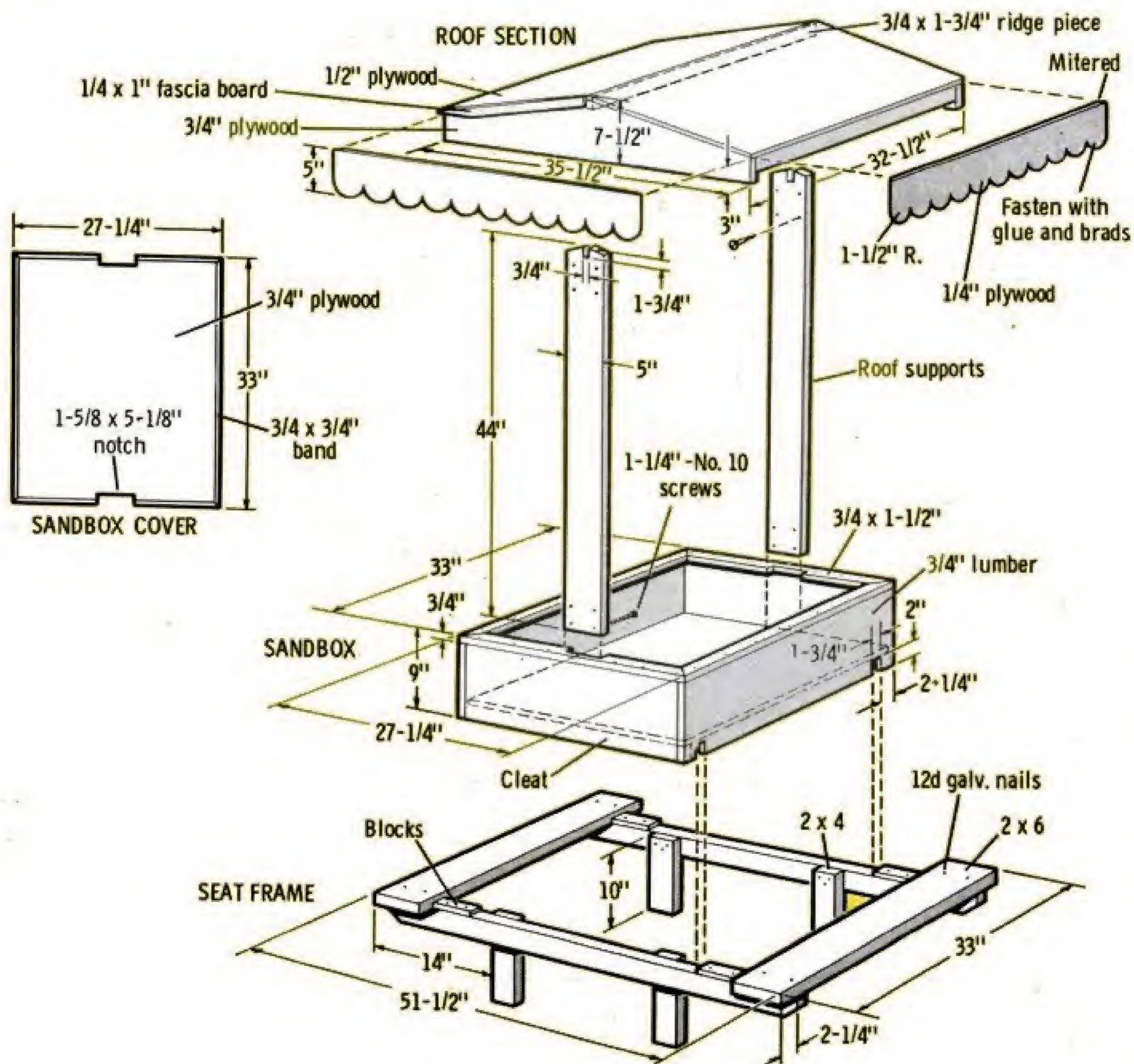
**THIS CUTE SANDBOX** and table will keep youngsters happy while outdoors, yet it can be disassembled easily for storage during the colder months.

The unit is composed of a seat frame, a sandbox with tabletop cover, a roof unit and the roof supports, all of which are detailed in the drawing below. You can use pine lumber or 3/4-in. exterior plywood.

The bottom of the box is raised 2 in. to clear the notches that allow the box to fit over the side rails of the seat frame. Don't try to do without the spacer blocks since they keep the box from sliding.

Painting the unit with bright colors makes it eye-catching, especially if the roof is striped. Use two coats of weather-proof enamel for a lasting finish.

—Victor H. Lamoy





# HINTS FROM READERS

## Tightening handsaw screws

When it becomes necessary either to tighten or remove screws holding the wooden handle to the blade of a handsaw, try using a file to keep the flat medallion and thimble nuts from turning. Position the file so its teeth bear against the round portion and clamp both file and handle in a bench vise. This makes an often-frustrating task easy.—*H. Josephs*



## Sticky tape cleans magnet

Iron and steel particles often are very difficult to remove from the poles of a magnet—try to brush them away and you'll find that the particles merely move from one section to another. You can do the job effectively, however, with the help of a few pieces of adhesive tape. Simply press the tape over the particles and strip it off. In certain cases, it may be necessary to repeat this procedure to remove all of the fine particles of metallic dust. Almost any type of tape will do the job.



## Brush-sand uneven surfaces

Sanding irregular or contoured surfaces is tricky at best—but a scrub brush can work in your favor. Simply wrap a sheet of sandpaper around the scrub brush as shown at right, secure the sandpaper to the wooden handle of the brush with a strong rubber band, and then use the brush as you would a sanding block. The stiff bristles of the brush will be flexible enough to follow the curves of the surface, yet firm enough to apply uniform pressure to the entire surface.



## Trimming a miter cut

When the cut you've just made on a piece of molding proves to be a hair too long, trimming that cut can be quite exasperating—the saw will keep slipping off. The solution—place the two pieces just cut so they butt against each other, then position the molding where the new cut is desired, and clamp the pieces securely to the miterbox. Using the second piece will prevent the saw from slipping into the first cut and reduce the chances of a ragged edge in the final cut.

—*Michael Ligocki*





# Handsome Garden Paths and Walkways



**BREAK UP TOPSOIL** and scoop out narrow trenches for wooden curbs treated with a good preservative

By **PETER OLDALE**

**A** GARDEN PATH made from blocks of stone or concrete is strong, durable, easy to lay (apart from the actual labor of carrying the slabs) and can be done in colors, materials or patterns to blend with almost any style of house or garden.

Yard for yard, slabs of concrete are on the low-cost side, but stone is a different matter. Dressed York Stone slabs are



**CAREFULLY POSITION SLABS** over loose soil. It's a worthwhile idea to first chart your layout of slabs



**TAMP THE SLAB** firmly into place by using the handle of a hammer—never pound it with hammer's head



# Inlay Stones in a Concrete Bed



**POUR A BED OF CONCRETE** and beat the mix down with a length of lumber. Make sure the form is level



**USE A TROWEL** in pounding fashion to bring fuzzy finish to surface. Smooth walks can be dangerous



**WHILE CONCRETE IS STILL SETTING**, scoop out portions and inlay stones, slabs or other material



**TAMP DOWN** until level. The cement will be forced up between the joints to be flush with the surface

one of the most expensive materials obtainable (besides being one of the finest in appearance). However, before choosing the material, check as many samples of slabs and stones as possible.

These can be plain gray concrete (the cheapest), colored concrete, textured concrete cast to imitate the irregularities of natural stone, or concrete that's topped with inlaid pebbles or stone chips. Common shapes are square, rectangular, hexagonal or octagonal, all suited for layout in many patterns. Great care must be taken with the colored slabs, however, or unnaturally garish effects may be produced. A single slab, viewed in a building supply yard, may seem subdued in shade, but a whole path or drive in this same material could appear impossibly bright.

Before ordering, lay a few slabs together on the ground and, if possible, wet them down—the color of wet slabs is markedly deeper than that of dry ones, and a path that looks restrained in summer may darken unpleasantly in winter rains.

Slabs are usually sold by the piece, thus

the actual cost *per square yard* will be greater for small slabs than for larger ones. Paths and drives should be planned for widths that can use standard-sized slabs, thus eliminating a need for cutting.

Where a pattern of various-sized slabs is desired, work out beforehand the exact number of each size needed. Suggested patterns are shown, but, of course, the variations possible are innumerable. In general, avoid patterns using large numbers of small pieces. These are hard to lay, susceptible to wear and expensive.

Octagonal and hexagonal slabs will not make a straight-edged path by themselves, so halves (for edges) and quarters (for corners) are needed. Again, detailed planning will give the required number of each kind. Paths laid out with these slabs should have only parallel edges and right-angled or 45° corners. Other angles are very difficult to lay satisfactorily.

Stone paving can be *random-squared* (various irregular squares or rectangles fitted together in patterns), or it can be *crazy paving*—broken flat stones fitted to-

*(Text continues on page 166)*



## Lay a Path With Built-In Greenery



**POSITION EACH STONE** carefully on a bed of soil and sand. It's best to start with the edge stones



**STAND ON THE STONE** and pound the soil under its edges to consolidate soil and level the stone



**BE VERY CAREFUL** when tamping stones around small plants. Otherwise you can damage roots



**CORNER STONES** should be as square as possible to maintain clean lines of the path or walkway



### Use Hexagonal Slabs for a Truly Distinctive Touch

**CONCRETE BLOCKS OF THIS SIZE** require a high standard bed of pure sand or sand/cement dry mix. It's important to smooth the bed carefully for every concrete slab, making sure that it's perfectly level





**INSERT CREEPING PLANTS**, such as thyme, or small plants, such as rosemary, as work progresses



**IF NECESSARY**, you can chip stone to fit awkward-shaped areas, but always wear safety goggles



**SPREAD FINE SOIL** over the completed walkway. It often is advisable to sift all the topsoil first



**BRUSH THE SOIL** into all the cracks and crevices at butt joints to produce a well-defined walkway



**WHERE A BLOCK MUST BE CUT**, make a pair of guide lines, each about  $\frac{1}{4}$ -in. off desired cutline



**USE A MASONRY SAW** to cut between the drawn lines, applying water liberally to lubricate the saw



**LOWER THE CUT BLOCK** gingerly into place on the bed, making sure that the smooth bed isn't disturbed



**FINE, SIFTED SAND** is then brushed into all cracks until every joint in the walk is completely filled



# Laying an Asphalt Path



**POUR A GENEROUS AMOUNT** of gravel on top of a firm foundation and rake it until it's spread evenly



**BREAK OPEN** the bags of asphalt and pour this on top of gravel bed. Asphalt comes in several colors



**RAKE OUT ASPHALT AT ONCE.** Heating the head of the rake over a low flame makes raking task easier



**A SPRINKLING OF COLORED CHIPS** will break the solid color and improve appearance. Then roll path

gether in the manner of a jigsaw puzzle.

Squared slabs can be bought by the square yard, but most stone is bought by the ton. The area a ton of stone will cover depends on its average thickness and its type. Sandstone, in particular, varies somewhat in its weight per cubic foot. The most direct method of finding out the amount to order is to telephone the materials dealer and ask how much of his particular stone will be needed for the area you wish to cover.

Delivery costs can account for a large part of the price since most quarries will not deliver less than a full truckload—say five tons. If this quantity is not needed, it may pay to seek a neighbor who also is thinking of laying a stone path, and share the load.

Small orders can be collected direct from quarries at a comparatively low price—and if a truck can be borrowed, this is the most economical method of purchase. Do not be tempted, however, to overload a small truck with great heaps of stone. Five or six hundredweight of crazy paving doesn't look very heavy, but it is better to make extra trips than to ruin the suspension or springs.

Garden centers, on the other hand, will deliver almost any amount, however small, but the cost per ton is high. The cheapest solid material is broken concrete slabs, often available from public works authorities, and these can be laid down as "crazy paving" in the same way as stone. They have the additional advantage of being even in thickness, which greatly simplifies the layout work.

Unquestionably the simplest of all paths to make is the plain gravel type, which consists essentially of a layer of gravel spread between some sort of curbing. The actual gravel may be either shingle (pebbles) or stone chips; both are available in various sizes and colors. There are also a number of gravels (known as *self-setting*) containing coarse clean stones and a high proportion of finer material. This causes a well-rolled layer of this material to set much like soft concrete.

Loose gravel can be rolled to consolidate it, but it will never become truly firm. However, this has its advantages, for even paths in a very poor state can be vigorously reraked to look almost new. Loose gravel should be about 2 in. deep for chips, less for shingle. ★ ★ ★





PORTLAND CEMENT ASSN. PHOTOS

## Tool Flagstone Joints in Concrete

USING A LONG PIECE OF  $\frac{1}{2}$  OR  $\frac{3}{4}$ -IN. COPPER TUBING in an S-shape, score a random flagstone pattern in the still-wet concrete (above left). After water sheen has completely disappeared, float and trowel the surface (center), and finally, use a soft bristle brush to touch up all of the joints (above right)



## Decorative Effects Cost Little, Add Much

STONES SET INTO SQUARE OF CONCRETE will create a novel pattern to offset a path otherwise made of gray-colored concrete blocks or plain-looking slabs

SIMPLE CIRCLES can be made to add life to a walkway made of cement. After the surface has been troweled smooth, use a can to make the impressions



# EXCITING NEW PRODUCTS

By CATHERINE BILSKI



**MAIL INDICATOR** is a step-saving device that eliminates unnecessary trips to the mailbox. Mounted on the top of the box, it has a flag that raises when mail is inserted. When you pick up the mail, you push the flag down to remake magnetic contact and reset it. The Mag-Na-Tel mail indicator is attached with two screws and fits all standard rural mailboxes. Priced at \$3.98 from Mag-Na-Tel Products, P.O. Box 833, Quincy, Ill.

**METAL HOLDER** converts any beer can into a handsome beer stein. Made of 21-ga. cutlery steel, the holder is brass-plated and individually boxed. When not in use as steins they can be used as decorative holders for flowers, pens, pencils, pipes, and so forth. Coasters are not needed since the base of the steins serve as insulators. Priced at \$3.98 a pair postpaid, from C. A. Bittner, Dept. P-5, Box 4732, Inglewood, Calif. 90302.



**ANTIQUING AND WOOD GRAINING** is made easy with this two-step kit. Both latex base and glaze are easy to apply and the entire process can be completed in only four hours. The finish is ideal for wood or metal and is safe for children's furniture. The Grain N Tique kit retails at \$4.49 and is available in fourteen decorator colors. Manufactured by Luminal Paints, Inc., 2750 S. Garfield Ave., Los Angeles, Calif. 90022.

**HOT WATER** at the touch of a finger is possible with the pushbutton dispenser built into the Ready Hot Water kitchen range. The 180°F. water for dehydrated soups, instant oatmeal or coffee is drawn from an insulated two-quart tank with a sealed, immersion-type heating element. Since the water tap is located on the range control it reduces sink-to-range trips. Manufactured by Frigidaire Div., General Motors Corp., Dayton, Ohio.







**CARTOP CAMPER** is designed to be carried on the family car, thereby eliminating towing problems. The unit sleeps four people on the top of the car and the box at the back of the sleeper converts to a combination stove, sink and table that seats six. The bathroom has running water from a 5-gal. tank, shower, basin, mirror and portable toilet. About \$300 basic (\$400 with accessories) from Camp'otel Corp, 2822 W. Lancaster, Fort Worth, Tex.

**STOVE-TOP BROILER** for gourmet broiled cooking at home, or when camping or boating, is a simple device that sits over the flame of a gas-stove burner. You control the flame that cooks your meat by adjusting the stove burner. The Char Broiler is priced at \$9.90 postpaid from Pelton Products, Dept. 1163, 13350 Poway Road, Poway, Calif. 92064.



**STOP UNAUTHORIZED USE** of electric appliances or tools with the Lock-A-Plug. It locks the prongs of an electric plug to keep it from being inserted into a power outlet. The plug is freed by setting the built-in dials to the correct combination and pressing the release button. \$2.50 from Efston Mfg. Co., Ltd., 400 Prairie Ave., Wilmette, Ill.







## Solve the patio problem ADD A SCREENED PORCH

If bugs and rain send you scurrying indoors from a patio cookout, it may be time to consider adding a screened porch.

By DON SHINER

Technical Art by Fred Wolff

**W**HEN IT COMES to practical outdoor living, you just can't beat a screened porch. Open patios are fine when there are no bugs or sudden showers, but one or the other can ruin a cookout. When you're safe from both within the shelter of a screened porch, summer entertaining and living become twice the fun for family and guests alike.

Adding such a porch is not the major job you may think. It's a project that can be completed in stages to suit both your spare time and wallet. And even before you have it fully screened in, you'll find it

usable for a cookout without worrying about getting wet.

The best spot for your porch is at the back of the house where you have the most privacy, but more important, where it will be accessible from the kitchen. If you are able to build it on the north side of the house, it will be shaded from the hot afternoon sun.

### Three-stage project

You can tackle the job in three easy stages: 1. Pouring the slab; 2. Framing the roof; 3. Adding the screens, all of which





**SLOPE THE FORM 2 in.** at front to assure proper drainage. Then divide form in sections for pouring



**AFTER EACH SECTION** is poured, smooth it with a steel trowel, then cover with burlap and keep moist



**CEILING JOISTS** are toenailed to a 2x6 nailer which is first nailed to the house at ceiling height

you can do yourself with help now and then from a friend. In most cases you'll be ahead if you have the slab poured. In time saved, you can have your porch completed over a two-week vacation.

If you take on the slab yourself, stake it out to suit and remove 5 or 6 in. of topsoil. Dig down 18 in. along the outer edges to form a trench to provide extra support for the roof. Erect form boards so the slab will pitch slightly away from the house ( $\frac{1}{4}$ -in. per ft.) and are level with foundation.

Regardless of size, it's best to pour the slab in sections, a day apart. This mini-



**CEILING FRAMING** is temporarily supported in level position by scrap props which rest on the slab

mizes cracking and makes it possible, when working alone, to trowel the concrete before it sets. As each divider is pulled out, a  $\frac{1}{2}$ x4-in. strip of expansion felt is tacked to the green section before pouring the next. When the slab is finished, cover it with building paper or burlap and keep it wet for four or five days, allowing the concrete to cure fully.

### **Framing the roof**

Before you start the roof, study the framing drawing on the next two pages. Each rafter is paired with a ceiling joist

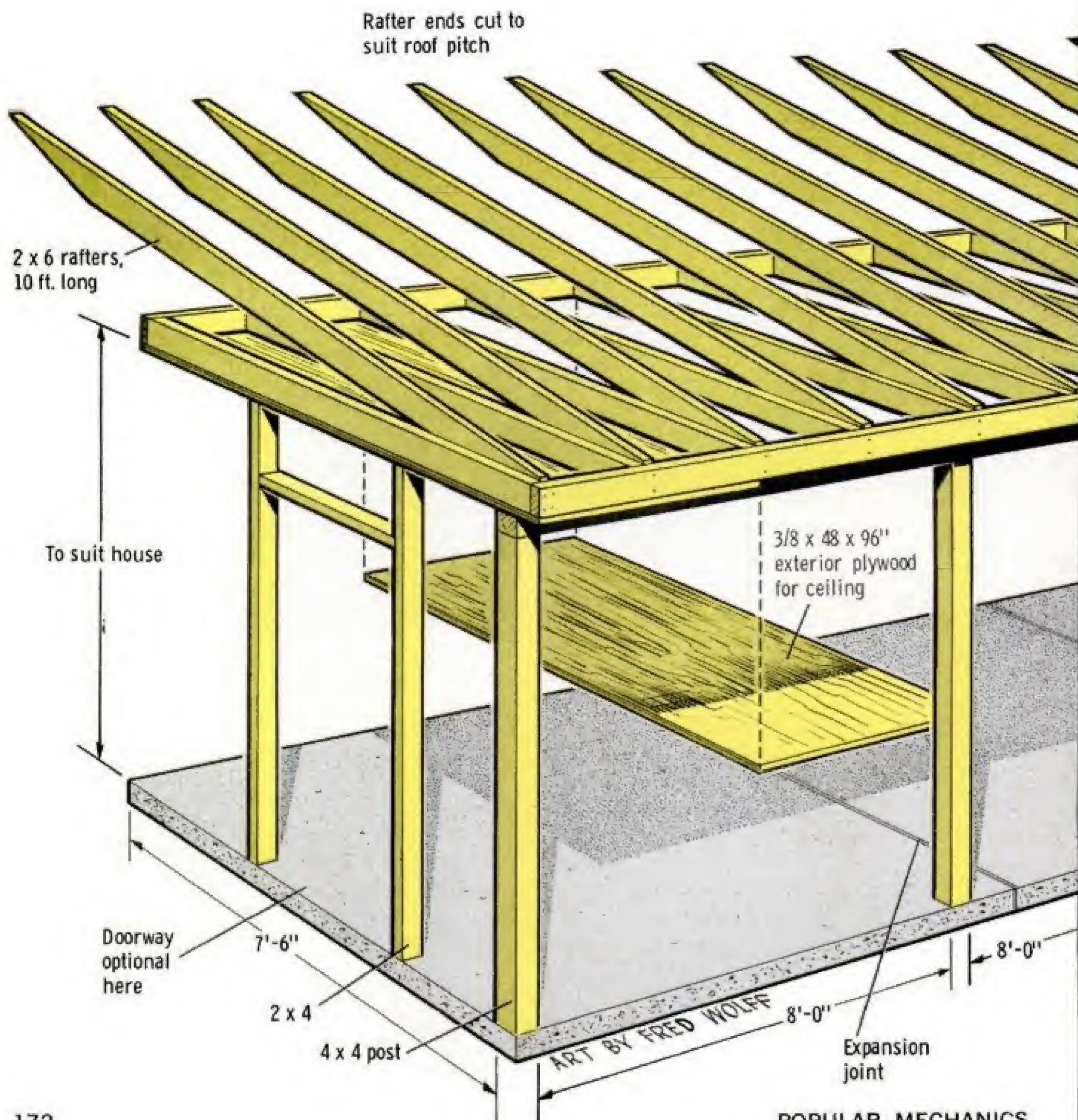




**TAPERED ENDS OF RAFTERS** rest on house roof to which they're nailed 24 in. o.c. Plywood covers rafters



**WHEN WIRING IS IN**, underside of joists is covered with  $\frac{3}{8}$ -in. plywood, butting joints on joists



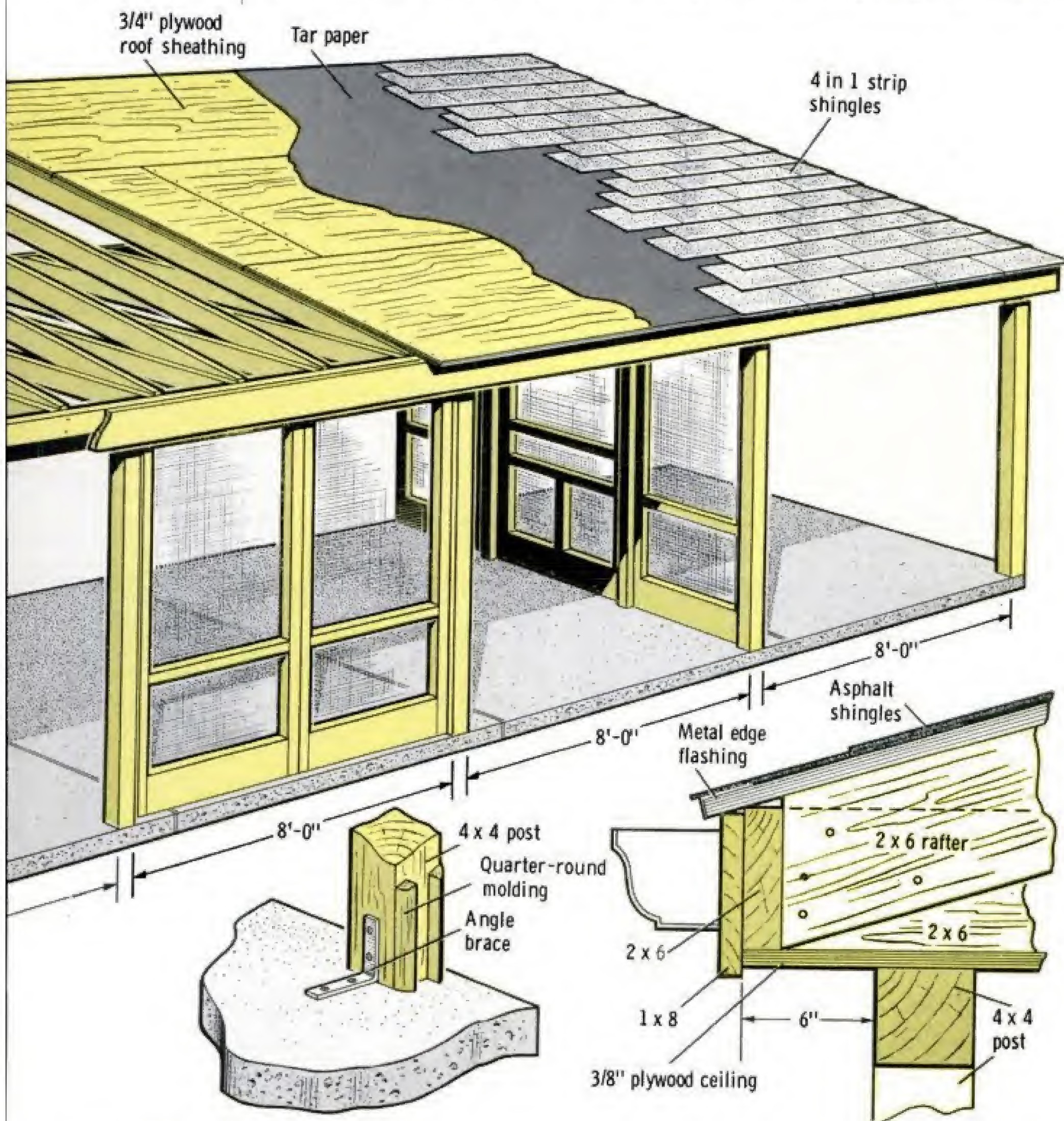




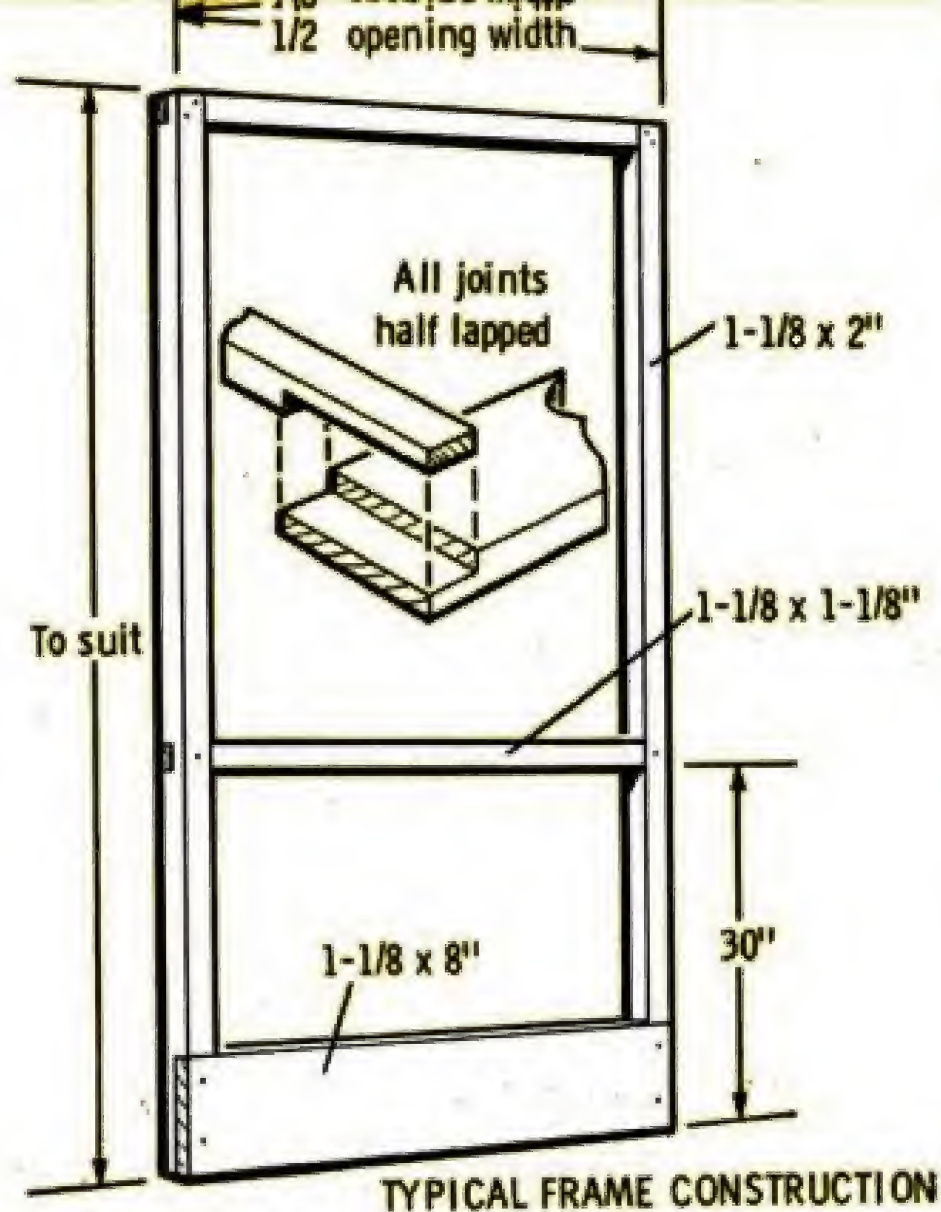
**PERMANENT 4x4 POSTS** are anchored to slab with angle brackets, then a 4x4 lintel is placed on top



**AFTER ADDING FLASHING**, roof sheathing is covered with building felt and matching shingles are applied







**SCREEN FRAMES ARE BUILT** with half-lap joints for strength. Make two frames for each 8-ft. opening

and the joists are faced on the underside with  $\frac{3}{8}$ -in. plywood before a lintel, supported by 4x4 posts, is placed under it.

Start by spiking a 2x6 nailer to the side of the house at ceiling height. This runs the full length of the porch. Next erect a box-like frame around three sides and prop it up temporarily in a level position. Now install the ceiling joists, 24 in. center to center, and toenail them to the nailer.

**QUARTER-ROUND MOLDING**, tacked to posts and lintel, provides neat rabbets in which screens rest



**SLIDING-DOOR BOLTS** lock screens to slab. Use masonry bit to drill holes in slab for sliding bolts

Spike them through at the front. After this, figure how many rafters are needed (two more than joists if you double up the end ones to make a flush surface) and cut one for a pattern. Taper the end to match the pitch of the house roof. Nail rafters to the roof, right on top of the existing shingles, and spike them to the joists.

Next, you close in the framing by nail-

*(Please turn to page 202)*

**DOORWAY IS FRAMED** in end with 2x4s for stock screen door. Openings around the door are screened





# HINTS FROM READERS

## Magnet for duplicate lengths

If your next woodworking project calls for cutting a number of pieces of wood to the same length, try this handy trick. Set a suitable magnet on the metal table of the saw and use this as a measuring guide. It's important, of course, not to hit the magnet with the end of the work, as pressing the work against it too much will cause it to slide somewhat.—*H. E. Roberts*



## Vise removes scissor screw

When it's time to tighten or remove the screw holding the two sections of a pair of scissors or shears, the screw usually is extremely difficult to turn. Try drilling a shallow hole in one jaw face of a sturdy shop vise, then insert the end of a short, stubby screwdriver bit into the hole. Using the vise as a press to hold the screwdriver bit in the screw slot, you'll find that a wrench slipped over the flat end of the screwdriver will provide enough leverage to turn the screw.—*H. Josephs*



## Candy box for small parts

The next time you decide to buy your wife a box of candy, make sure the inside of the box has the one-piece plastic divider that holds the candy in place. Then, after helping to empty the box, snap up the remains and carry them off to your workshop. There, you'll discover, the box is the right size to fit inconspicuously on a shelf—and the dividers in the box make ideal storage compartments for such workshop miscellany as screws, nails, nuts and washers.—*Joseph Braunstein*



## Keep a roofing brush soft

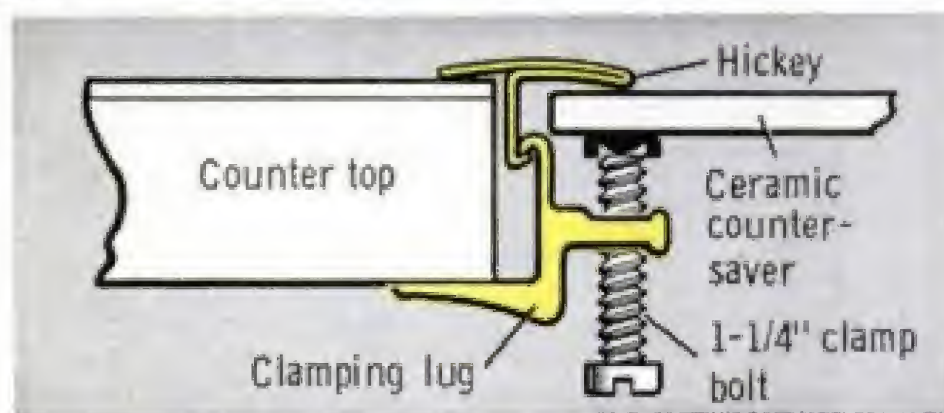
These few steps take only minutes, yet they allow you to keep a roofing brush soft for days, even weeks, between tarring sessions. First moisten the brush in kerosene, then work out the excess by brushing over old newspapers or over an area to be tarred later. Next wrap the brush with a few layers of newspaper, enclose it in a plastic bag and bind the bag tightly around the handle with a cord. Be sure the seal is airtight, or the brush soon will dry out.—*Walter E. Burton*





# How to Save Wear

By WAYNE C. LECKEY, Home and Shop Editor



**AFTER TRACING PATTERN** on counter, hole is made for blade of sabre saw which is used to cut opening

**T** IRED OF BEING A SLAVE keeping your home from looking old before its time? Just keeping pace with normal everyday wear is a never-ending job.

You can do a number of things to keep up with this daily wear and tear. For example, you can keep walls free of finger-marks around switch plates by adding protectors. Made of clear plastic, they simply fit under the plate. All you have to do to install one is to back out the two plate screws, remove the plate, place the protector over the toggle and screw the plate back on. Such protectors are invaluable in the case of a papered wall where soil marks are difficult, if not impossible, to remove.

Preventing doorknobs from bashing dents in the walls will help keep your home from looking beat up. In addition to the common, shin-bruising baseboard doorstop, there are a couple of new types on the market. One, made by Stanley, is designed to fit on the upper door hinge. It not only keeps the door from swinging back and hitting the wall, but also limits the distance the door can open. To install it you simply drive out the hinge pin, insert the pin through a hole in the stop and drive the pin back into the hinge. It costs about 50 cents.

A new 2½-in. rubber stop made by the H. B. Ives Co. comes in a choice of solid and concave shapes, and provides a non-marring cushion for the knob. Called a



**THEN CAULKING IS APPLIED** to rim and Counter-Saver is positioned. Hook clamps lock it from below



# and Tear on Your Home



**TOUCH-BAR LATCH** has closer inside to ease door shut. Bar "handle" opens the latch at a simple touch



**SCREEN-DOOR GRILLE** is not only decorative but guards against bellied wire when pushed by kids

wrought wall bumper, it's mounted on any type of wall at a point where the knob would normally strike. It's priced from \$1.98 to \$2.75 depending on finish.

You can add metal kickplates to the front and back doors. This pays off handsomely, particularly when, because of weatherstripping, a door is hard for youngsters to open without an assist from their feet. Such brass or aluminum

guards will prevent scuff marks and a beat-up look. An aluminum one costs \$5.50.

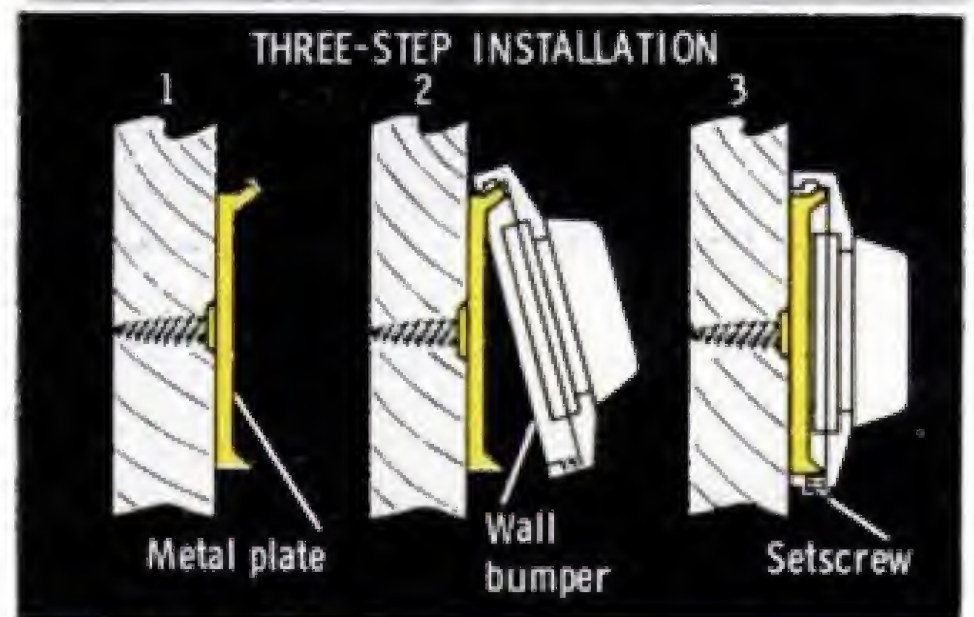
Metal nosing applied to basement stairs will prevent wear and tear, even when the steps are not tiled. When unprotected, bare wood steps are subject to splintering along the edge, and tiled steps soon show signs of chipping—to give them a shop-worn look.

Among more extensive things you can

**ALUMINUM GUTTER COVER** prolongs life of galvanized troughs and eliminates messy chore of cleaning







**STOPS SUCH AS THESE** will prevent knobs from damaging walls. Adjustable hinge-pin type limits door swing. Rubber bumper mounted where knob strikes wall, lets door swing open all the way but cushions knob



**CLEAR PLASTIC PROTECTORS** over switch plates save painted and papered walls from unsightly soil marks

add to save wear and tear is a drop-in Counter-Saver made by Corning Glass Works. You know what happens when, unwittingly, you place a hot pan on a kitchen counter. The plastic top is marred for good with an ugly imprint. However, with an insert of Pyroceram in the counter, you can set the hottest skillet or casserole on it without worrying. It costs about \$25—less than the cost of replacing a whole damaged counter.

Installation of this protective ceramic requires the cutting of an opening in the counter. A cardboard template comes with the kit which you trace on the counter before drilling a hole for starting a sabre-saw cutout of the opening. A stainless-steel rim (bezel), like the one around your sink, is provided to cover the rough opening. Caulking is applied to the rim before it is pressed gently in the opening and locked in place with clamps applied from below. You can get complete kits in 16x20 and 18x24-in. sizes.

Combination storm and screen doors take a beating, and not from kids alone;



without some type of chain or spring check, the wind can tear such a door from its hinges, or it can wreck itself slamming shut. Here is where a pneumatic door closer is a good investment. A new dual-purpose closer by Ideal Security Hardware Corp. is housed inside a touch-bar latch. You can unlatch the door from the inside merely by bumping the bar with your arm, knee or body. In being inside the bar, the closer is at midpoint on the door, where it works best. This latch sells for \$9.95, can be tailored to fit any width door and comes with complete instructions for installing.

Screen inserts of combination doors are



**METAL KICKPLATES** will prevent scuff marks when kid's toe is used to help open tight-fitting door

not free from wear and tear. Let a small child or pet push against the wire and you'll have a belly in it you can't remove. Before this happens, it will pay you to add decorative push grilles to both sides of the door. Macklanburg-Duncan sells the attractive grille shown on page 177 for \$6.75 but you can get less fancy ones in various finishes and designs.

What's a bigger headache than roof gutters! Let them fill up with leaves and muck and you'll wind up with clogged downspouts and blocked sewers. Gutter covers not only will save you the messy chore of cleaning gutters, but will prolong their life. The weight alone of clogged gutters will cause them to droop and sag. When water can flow freely, there are no standing pools that can cause galvanized gutters to rust, deteriorate and leak. Made of expanded aluminum mesh 6 in. wide, the gutter cover comes in 25-ft. rolls and in 36-in. straight lengths. A roll of Nichols Aluminum Co. gutter cover costs \$2.99, while a package of

*(Please turn to page 218)*



**OUTSIDE DRINKING FOUNTAIN** will curtail extra trips inside. This one screws onto regular sill cock



**METAL STAIR NOSING** will save basement steps from scuffing and chipping of tile along front edge

**PERFORATED SPRINKLER CAP** over downspout will prevent gushing, puddling of water near foundation

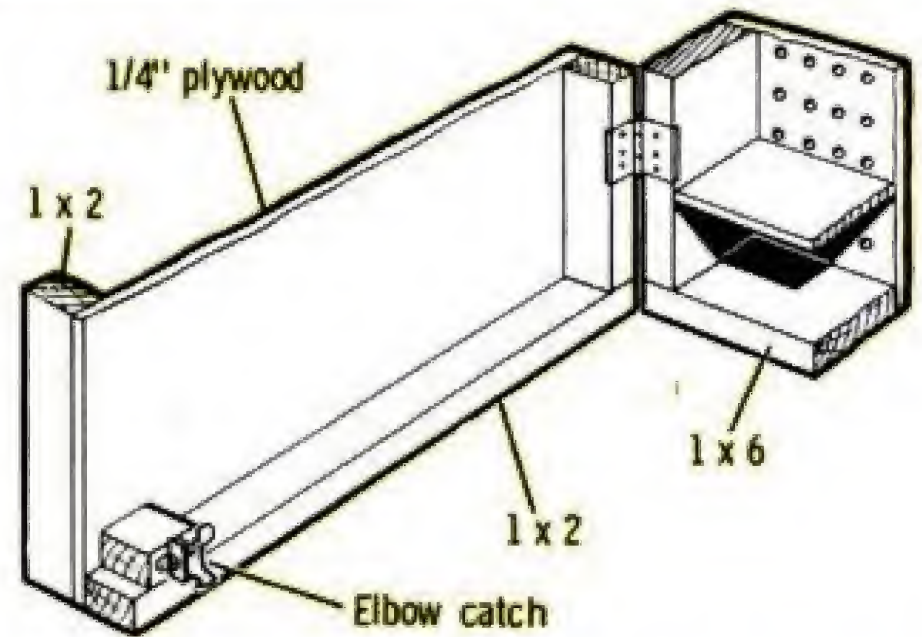




# Stressed-skin doors for storage cabinet



Doors for a workshop cabinet, laundry room or basement storage unit are easy to make and twice as easy to hang if you use a stressed-skin construction technique similar to that in aircraft (the load—weight of the door—is borne by the plywood skin, while the strips serve only as stiffeners). The door weighs so little that pivot-type hinges are adequate even for large doors. Hardware costs are further reduced since the protruding stiffeners act as handles.—*Charles H. Welch*



## Vise improvised from C-clamp

You can convert a C-clamp into a bench vise with a simple modification costing but a few minutes' time and possibly a few cents for screws. As shown at right, this method offers the additional advantage of providing a flush work surface so you can clamp a long board anywhere along its length. To mount the clamp, first drill its frame for a pair of suitable wood screws to hold it against the end of the work table. When positioning, make sure the clamp's adjusting screw clears the table.



## Turn can opener into staple puller

You won't need to risk broken fingernails if you make a handy staple and tack puller from a discarded can opener. Simply bevel the underside of the pointed end to reduce its thickness so it will slide under staples. Also grind the other end until it's quite thin; then file a V-like notch in the center of the slightly rounded edge. To pull thumbtacks, simply slide the round edge under the head of the tack, and position the notch so it clears the pointed shaft of the thumbtack.—*William Swallow*



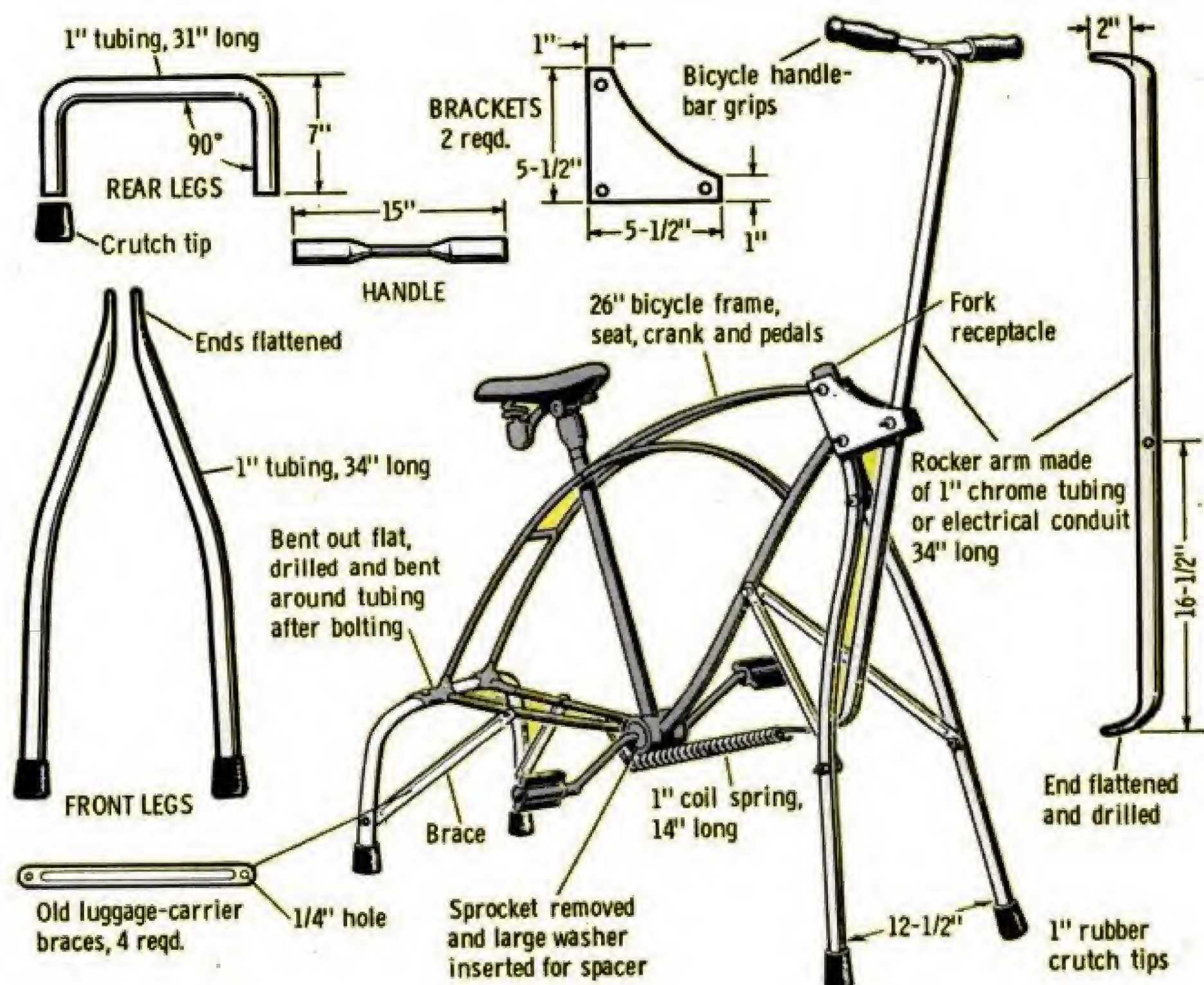


# Keep Trim With This Dual-Action Exerciser

THAT OLD BICYCLE rusting away in your garage can be put to work as a dual-action exerciser to help you to keep in good physical shape. While you pedal in bicycle-fashion and simultaneously pull against a spring-loaded handle, your leg, back, arm and even your neck muscles are rhythmically put into action.

To begin construction, strip the bicycle of all parts except the seat, crank and pedals. Disassemble the crank, remove the sprocket and replace the sprocket with a suitable washer. Next, reassemble the crank and tighten the cones to obtain the force desired for turning the pedals.

The stand is made of 1-in. chrome tubing bent as shown. If the tubing is hard to buy in your area, substitute 1-in. electrical conduit. The handle and the long front arm also are bent to the shapes shown. The bottom of the front arm is connected to a 14-in. long coil spring, the other end of which is attached to a hole drilled through the rear fork.—*John A. McKee*

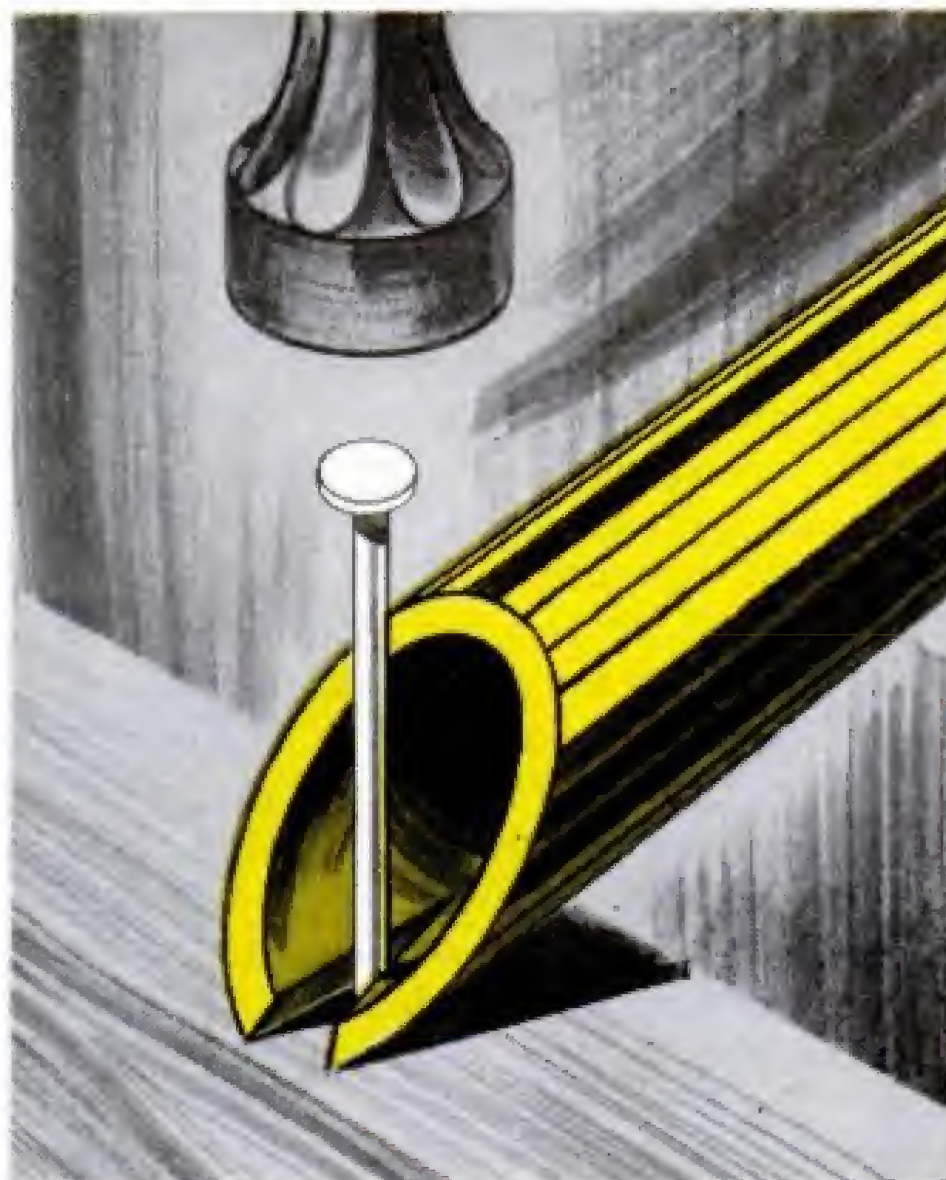




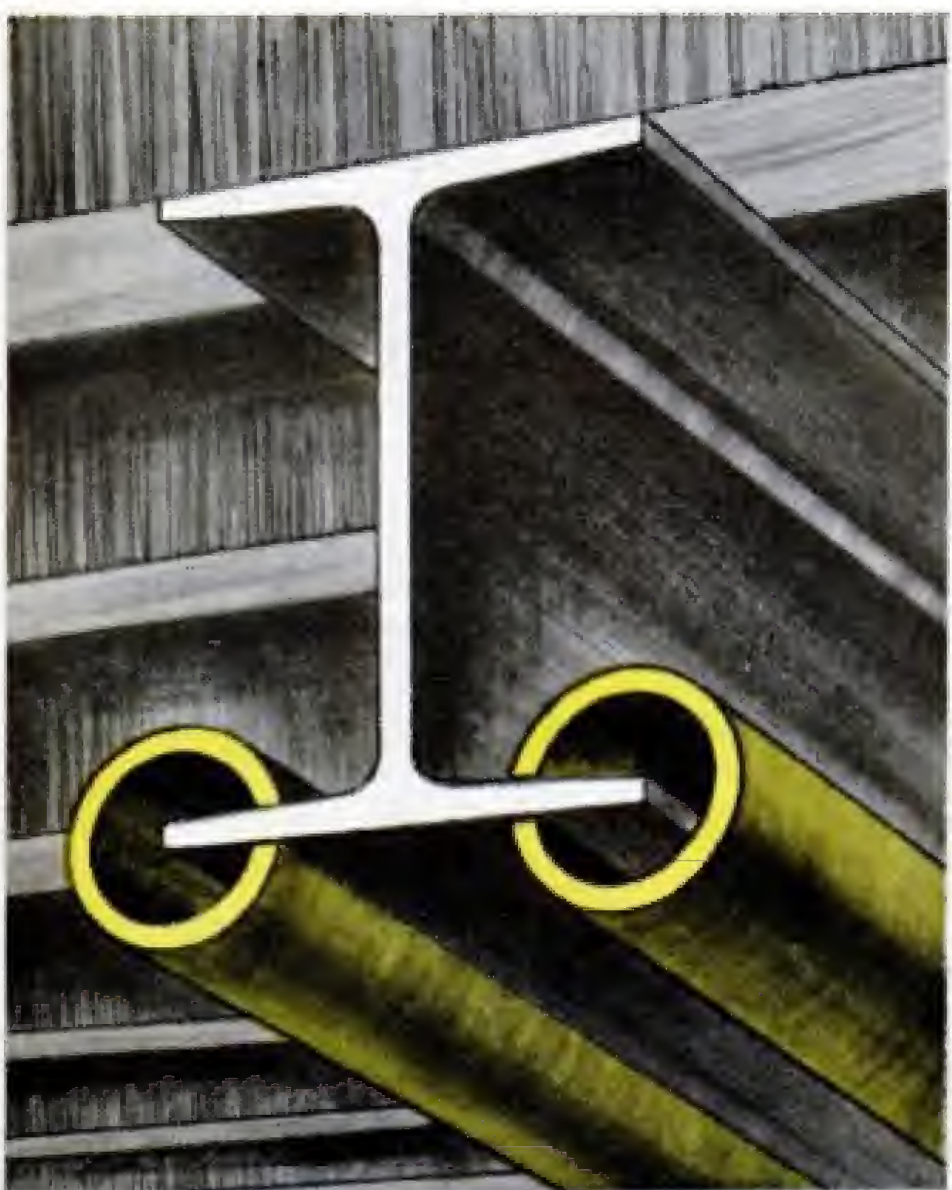
# Solving home problems



**MUD CARRIED ONTO LADDER RUNGS** is not only a mess, but also dangerous since it can cause you to slip off. A simple solution is to attach a sturdy shelf bracket to the ladder for use as a convenient scraper



**MOST EVERY PROJECT** calls for driving a nail in a spot that's awkward—especially when it comes to starting the nail. You can use a piece of scrap garden hose, slotted as shown, to hold the nail in place



**STEEL I-BEAMS** present a headroom problem in many older homes, especially those with storage cellars later converted into livable basements. To protect heads, use 2-in.-dia. cardboard tubes as shown



**DON'T THROW AWAY** those old "peat" plastic bags. Make good use of them when laying stones in a rock garden by laying down opened bags, then placing the rocks. This keeps weeds from growing around rocks





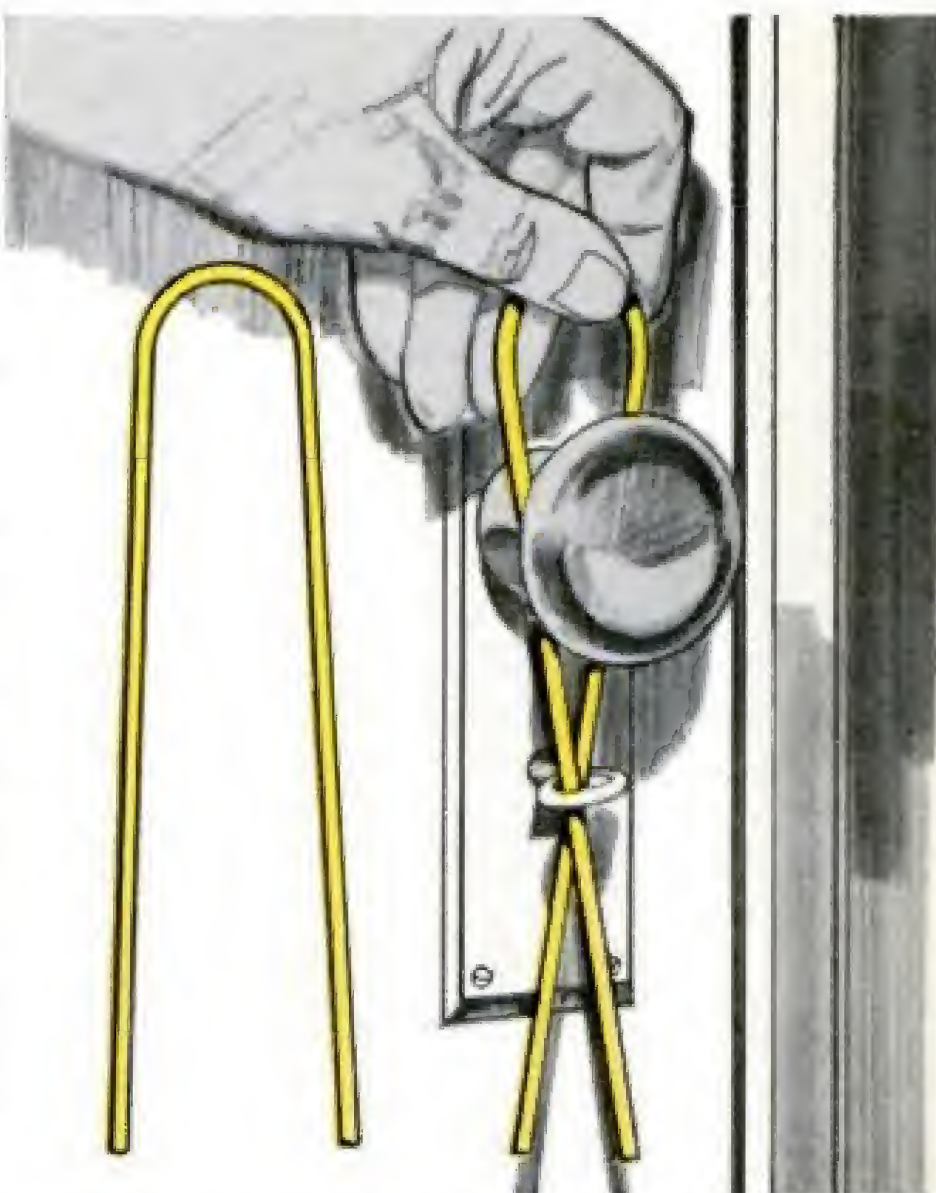
**MAKE A HANDY TACKPULLER** from an old double-edge razor by filing a notch in one edge. Discard the underpiece that normally seats the blade and you'll find that the notched curve top does the job nicely



**WHEN MAKING SMALL DRAWERS** for a workbench or cabinet, eliminate the need for elaborate hardware by using the drawer bottom as a slide. The simple slide needs only a bit of wax for smooth operation



**STRONG WINDS** can't lift the covers of your trash cans if they're fitted with a pair of 16-penny nails as illustrated. The nails should be positioned 180° apart and held to the cover with short lengths of chain



**OLD-FASHIONED DOOR LATCHES** can be burglar-proofed by fitting them with a length of coathanger wire as shown. The wire prevents the key from being pushed out of keyhole, then slid under the door



# 6 Ways to Make

By DAVID X. MANNERS



**CULLIGAN'S AQUA I PURIFIER** is made for mounting vertically as shown or horizontally under cabinet

**D**ON'T BLAME the waterworks if your water tastes bad. Or if it stains your sink and corrodes your plumbing. Or if it won't lather. At eight tons for a dollar, delivered, what do you expect?

If you have your own well, as one in four do, you already know what many people using public water are beginning to learn. Quality water isn't free and a public system can't be expected to provide it.

Here's why: Less than one percent of all water goes for drinking. Less than 10 percent of it goes for household uses. More than 90 percent of it goes for such other things as cleaning streets, fighting fires, cooling buildings, watering lawns and carrying away sewage—who needs soft, sparkling, delicious water for that?

The people who run our water systems produce the safest water in the world and the price is incredibly low. So if you want

## HOW WATER PURIFIER WORKS

- 1 PREFILTER.** Water first passes through a porous cellulose filter to prevent foreign matter from clogging the membrane surface.
- 2 REVERSE OSMOSIS MEMBRANE.** This special semipermeable membrane, of cellulose acetate wound spirally on a central core, has 5 square feet of surface which rejects dissolved minerals and organic matter from water, while allowing purified water to pass through. Operates with normal water pressure.
- 3 FINAL FILTER.** Activated carbon filter adds a final "polish" to the purified water. Molded plastic case serves as 3-gallon water reservoir.





# Bad Water Good

better water for drinking, laundering or bathing, it's up to *you* to provide it. The only economical way to get quality water is by point-of-use treatment using purifiers, filters, softeners or conditioners.

● *That terrible taste.* Many people solve the problem of bad drinking water by buying bottled water. It's a good way to get acquainted with how much better water can taste, but it may cost you 55 cents a gallon—and you have to lug it home. A better way is to make your own. A new purifier, born of the space age, now makes it possible to produce bottle-quality water right in your own kitchen for as little as 6 cents a gallon.

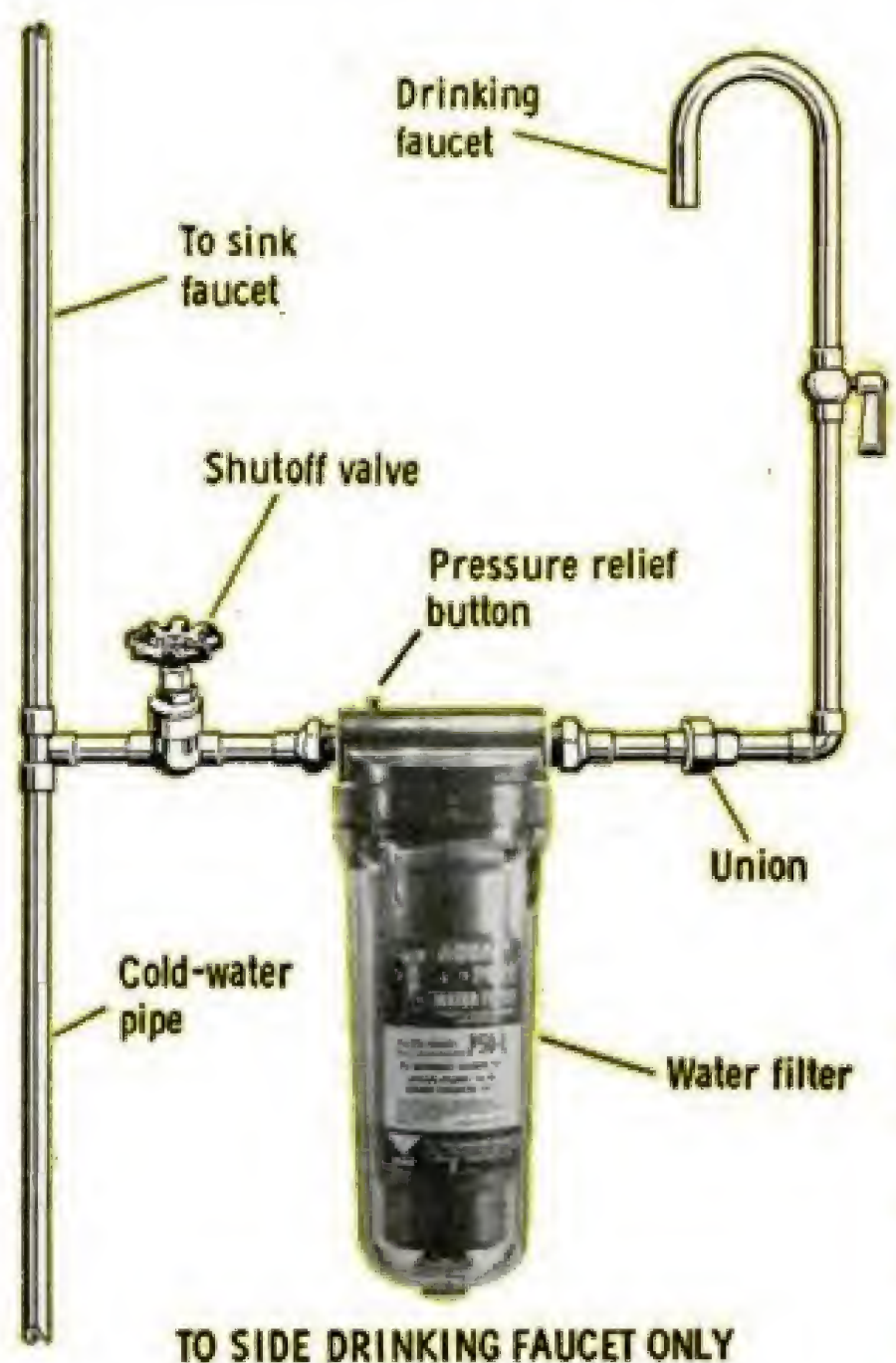
The purifier, employing a cellophane-like membrane and a process called "reverse osmosis," turns back almost every insult water can hand you. It stops chlorine, detergents, organic matter, undesirable minerals and salt. It is the first economical way to purify brackish, gypsum or alkaline water. Under some circumstances it will even stop bacteria and virus. It requires no electrical connection since it works on water pressure alone.

About the size of an attaché case, Culligan's Aqua 1 purifier, shown at the left, can be installed on or under a kitchen wall cabinet or wherever you have free wall space. A  $\frac{3}{8}$  or  $\frac{1}{4}$ -in. copper line supplies water to the unit. A tiny capillary tube carries away removed contaminants. By restricting water flow, the capillary tube helps maintain pressure on the membrane. Result—about 3 gallons a day of the finest water anywhere. The reservoir is right in the unit. Lindsay and Presto make a membrane-type purifier, too.

It's water that is crystal clear, excellent for drinking, beverages, cooking—including the making of juices, soups and gelatine desserts. It is recommended for infant formulas, low salt diets and ice-cube connoisseurs. People who have used it say it makes for happier tropical fish, more luxuriant potted plants and spotproof photo processing. They use it in steam irons, vaporizers and automobile batteries.

The purifier that can do this rents for

## TYPICAL UNDER-SINK INSTALLATIONS







**THIS COUNTERTOP FILTER**, which needs no plumbing, attaches to faucet, bypasses nonfiltered water



**THIS PLUG-IN FILTER**, called Aqua Spring, is hand filled, works by distillation rather than filtration



about \$6.50 a month, which includes service. But there is an installation tab of from \$12 to \$20. If you want to buy one outright, the suggested price is \$195.50. The membrane requires replacement (about \$40) every two years or so.

Want something less expensive? Highly effective in improving water where taste and odor problems are not severe are small cellulose and/or activated carbon filters, such as Cuno's Aqua-Pure shown on page 185. These sell for about \$30 to \$40 each, with replacement cartridges that range from \$2.50 to \$13.

Usually, both a cellulose type and an activated charcoal cartridge are used in combination. The cellulose type removes suspended matter and makes murky water clear. The activated carbon one removes tastes and odors.

Typically, these filters are of clear plastic or stainless steel and are attached to the cold-water line under the sink.

If the area under the sink is not accessible, the filter can be installed in the basement beneath the sink. Only one shutoff valve is required, on the inlet side of the filter. A pressure-relief button on the inlet side of the filter head is used to relieve the pressure for easy sump removal and replacement. While you can run the filtered water to your regular cold-water



good filtered water for just drinking and cooking purposes.

Under-the-sink filters like these are made by Cuno Engineering Corp., Pall Corp., Everpure Inc., and others. Everpure recently introduced a filter that combines purifying and taste-and-odor removal in a single cylinder. It uses diatomaceous earth instead of cellulose, blends it with activated charcoal. Cartridges last about a year, cost \$9. The same company also makes a filtered water faucet kit for \$18.

You want to avoid plumbing? Then get a filter that goes on the sink counter instead of under it. It has lines that attach to the end of the sink faucet, but you can still use the faucet to run nonfiltered water. Eaton has a plastic one of this variety for about \$25. Everpure has one in stainless steel that will filter cold water for

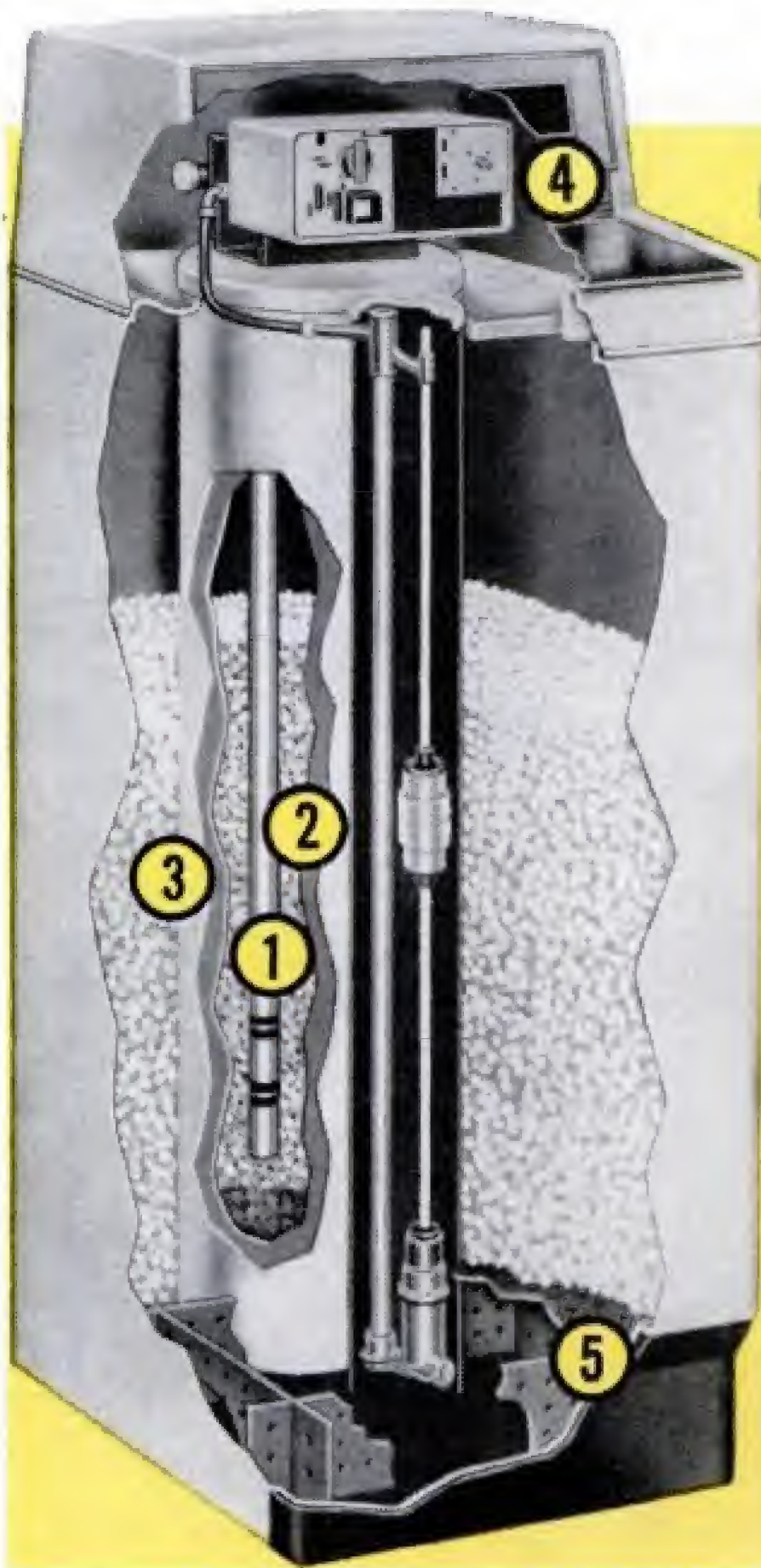
drinking, hot water for tea or coffee. It costs \$98.

Bargain filters, where the complete unit screws onto the faucet, are too small to be effective. They also are easy targets for unsanitary sink splashes.

Still another type of water purifier works by distillation rather than filtration. Called the "Aqua Spring," it's a \$70 plug-in device that the manufacturer (New Medical Techniques) claims will produce safe water from any source, salt or fresh. It produces two quarts at a filling. There is no plumbing since it's filled by hand.

Another hand-filled, nonplumbing filter is Crystalab's Water Freshener. Here you simply fill a 32-oz. squeeze bottle with cold tap water and place it inverted over a special activated charcoal. In minutes you have a decanter full of freshened water, free of odor, discoloration and taste. It will freshen 600 or more quarts of water

*(Please turn to page 218)*



## HOW A WATER SOFTENER WORKS

- 1 AQUA-SENSOR.** Two sensors located at bottom of the ion-exchange resin bed electronically detect the difference in water hardness and signal the solid-state controller. When hard water reaches the upper sensor, the lower sensor is still immersed in softened water. At proper time, unit automatically recharges.
- 2 RESIN SOFTENING BED.** Long-life resinous mineral of high softening capacity.
- 3 RESIN BED TANK.** Resinous mineral is held in rugged steel cylinder which has an inner and outer liner of heavy plastic.
- 4 SALT BED PLATE.** Plate allows any insoluble matter in the salt to settle out, preventing clogging of the brining system.
- 5 BRINE SYSTEM.** An electrically operated valve, plus a mechanical float valve, prevents overfilling or overflowing.



# High-Speed Duplicating Machine Makes You an Expert Woodcarver



**ANY STANDARD ROUTER** up to 1 hp can be used. Three clamps anchor it to heavy cast-iron frame, bolted to large wood base



**CUTTER AND STYLUS** are aligned using tool with hole in bottom to accept stylus

POPULAR MECHANICS



By **WAYNE C. LECKEY**  
Home and Shop Editor

**I**F YOU ALREADY HAVE a portable router and can plunk down \$75, there's a new carving machine waiting for you at your hardware store which will make you an expert woodcarver overnight.

It's called Hobbi-Carve and with it you can carve exact replicas in 3-D of any master pattern you follow. The finished carving becomes a perfect same-size copy down to the original chisel strokes.

I just gave this precision machine a whirl and found it to be a lot of fun. But I should warn you, like all routers it makes a lot of noise.

It works something like a pantograph in that it has a stylus which follows the master pattern. As the stylus moves over the "hills and valleys" of the pattern, the router carves the very same contours in a wood or plastic blank mounted under it. You can't goof because the stylus won't let you. The router will carve only as deep as the stylus dictates.

Differing from earlier carving machines in which the cutter and stylus moved over the pattern and blank, here it's just the reverse. The cutter and stylus are fixed; it's the blank and pattern that move. This is accomplished by a two-level "free-wheeling" table. The pattern is mounted in the lower level and the blank on top. Because the table is spring-loaded, it keeps the stylus bearing constantly against the pattern and the cutter against the blank. To move the floating table freely around under the stylus and cutter,



**FINAL FINE-LINE CARVING** is done with a pointed cutter after roughing-down blank with large cutter

you simply push down on two convenient hand knobs.

The master pattern can be made of anything (wood, plastic, plaster, metal or stone) as long as it's flat on the back and has no undercuts. Your carving blank, however, should be hardwood, such as walnut or ash, to produce crisp, clean-cut outlines. Pine doesn't work well. Blanks are bandsawed to rough size  $\frac{1}{8}$ -in. larger overall than that of the master pattern. Alignment of both pattern and blank is important.

The machine comes with two styli and two matching cutters (a large one for the initial roughing-down operation, and a fine one for final carving) and a plastic see-through workshield. You can order the machine complete with router if you wish. Hobbi-Carve is made by Saint Paul Machinery Mfg. Co., Southwest Fourth St., Osseo, Minn. 55369. ★★★



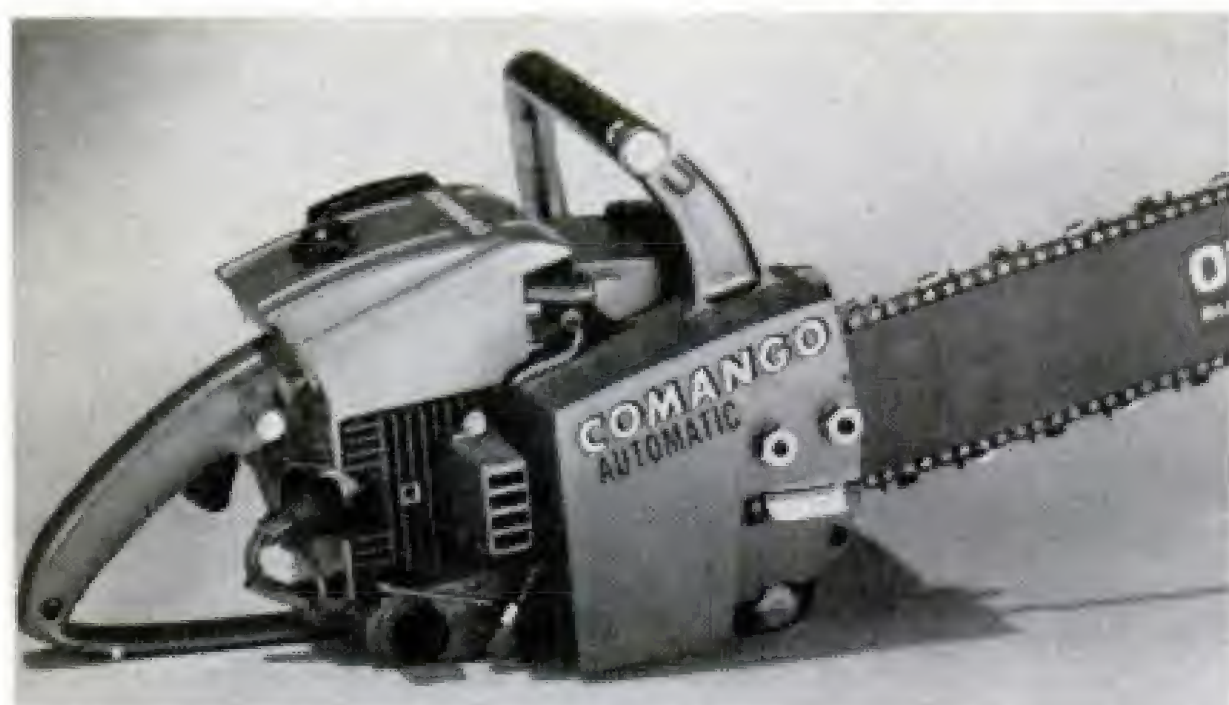
**DOUBLE-BACK TAPE** is used to attach pattern as well as the blank to the "floating" spring-loaded table



**BLANK IS STUCK** to top of table, pattern to bottom. Protective wood carving surface is added to top



# New Tools You Should Know About



**LOW-PRICE CHAIN SAW** called the Comango, with 4.2-cu.-in. displacement features "guardian" oiling system which is throttle-controlled so chain gets more oil automatically as speed increases. It has a 12-in. bar and chain powered by a two-cycle engine with an all-position diaphragm carburetor. Manufactured by American-Lincoln, 518 South St. Clair St., Toledo, Ohio 43601.

**CURVED JAW** of Channel-lock's tongue-and-groove pliers provides greater grip and more positive leverage on curved or round objects. The 9½-in. size has five-jaw adjustment, 1½-in. capacity; 12-in. size, seven adjustments, 2¼-in. capacity. Channel-lock, Inc., Meadville, Pa.



**HOIST-WINCH-PULLER** all in one is the Pow'r Pull, which has a 15 to 1 ratio and a rated capacity of two tons. Operates in any position, has no ropes or chains to tangle, weighs only 8 lbs. Useful in fence building, garage work and machine-tool moving. Two-ton model sells for \$38.50 from Massdan Pow'r-Pull Inc., 3130 North Hollywood Way, Burbank, Calif.



**HEAVY-DUTY ENGRAVER** provides a fast permanent method of marking all types of materials from hardened steel to glass. Works as easily as writing with a pencil. Calibrated stroke adjustment regulates depth of engraving from delicate fine lines to deep marks. High-speed reciprocating motor delivers 7200 strokes per minute. Comes complete in molded plastic case, and with extra points. Made by Dremel Mfg. Co., Racine, Wis. 53401.



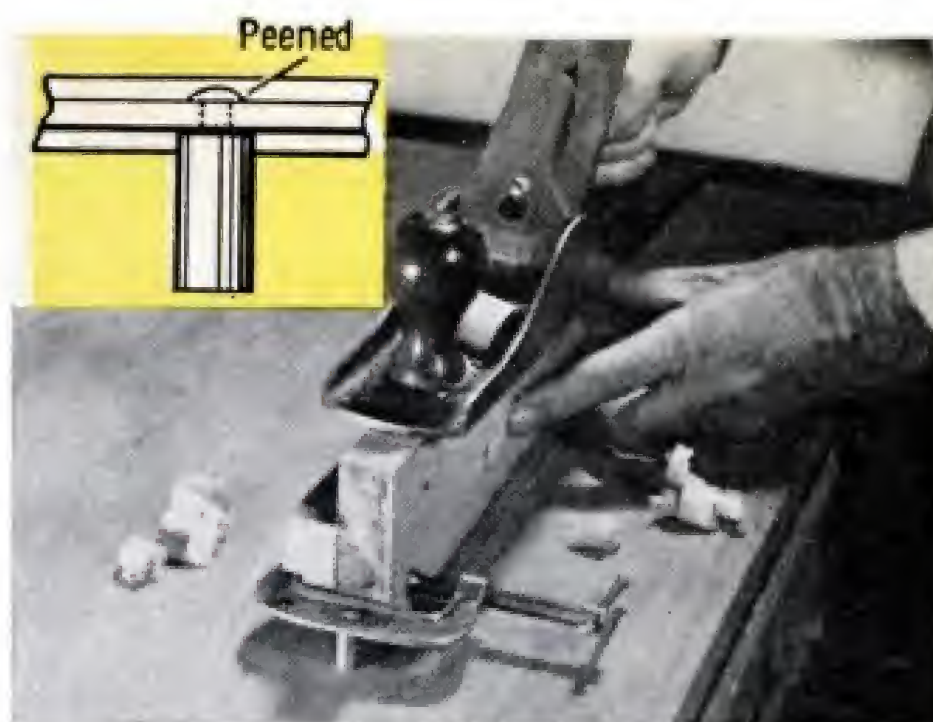
**PROFESSIONAL** two-speed, 9-in. polisher/buffer virtually eliminates chance of "burning" any auto finish. Free-wheeling rotary action retards speed when user applies too much pressure. "Oscillating" head has powerful ½-in.-throw, orbital motion to eliminate swirl marks. Oversize 10-in. polishing wool bonnet is cushioned by Ethafoam pad. Has ½-hp motor, weighs 9 lbs., sells for \$59.95. Wen Products, 5812 Northwest Hwy., Chicago 60631.



# HINTS FROM READERS

## C-clamp as a bench vise

Peen a length of pipe or heavy rod at right angles to a C-clamp frame and you have a handy workbench vise. Simply drop the stud projection in a hole drilled in the top of the bench, insert the work and tighten the clamp. You could also drill and tap a hole in the end of the rod, drill a hole through the clamp and attach the rod with a screw.—*Clarence Preitenfeldt*



## Tape holds hose clamp open

Without special pliers, spring-steel hose clamps can be the hardest things to hold open when they're being installed. Invariably they'll twist and fly off the jaws of common pliers. After having this happen several times, I hit upon the idea of using tape to hold them open. This made it easy to place the clamps over the hose and to release them by simply cutting the tape. As a safety precaution, a wire yoke (see photo) will keep the clamp in tow while it's bound with tape.—*Daniel Boucha*



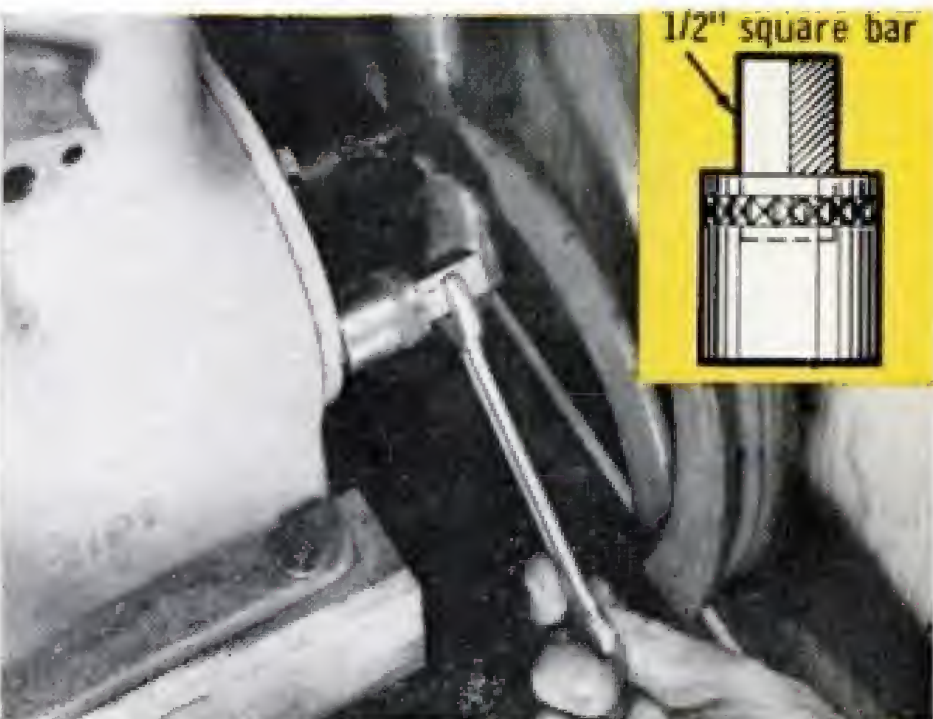
## Foil keeps can rim clean

There are any number of ways to keep the rim of a paint can free of paint, including the stunt of making nail holes in it for the paint to drain back into the can. However, perhaps the simplest way of all is to crowd aluminum foil into the can rim as soon as the cover is removed. Then, no matter how much paint spills over the rim, you simply pull out the foil when you're ready to quit. The rim will be clean as a whistle and the cover will fit as tight as it did originally.—*Ken Patterson*



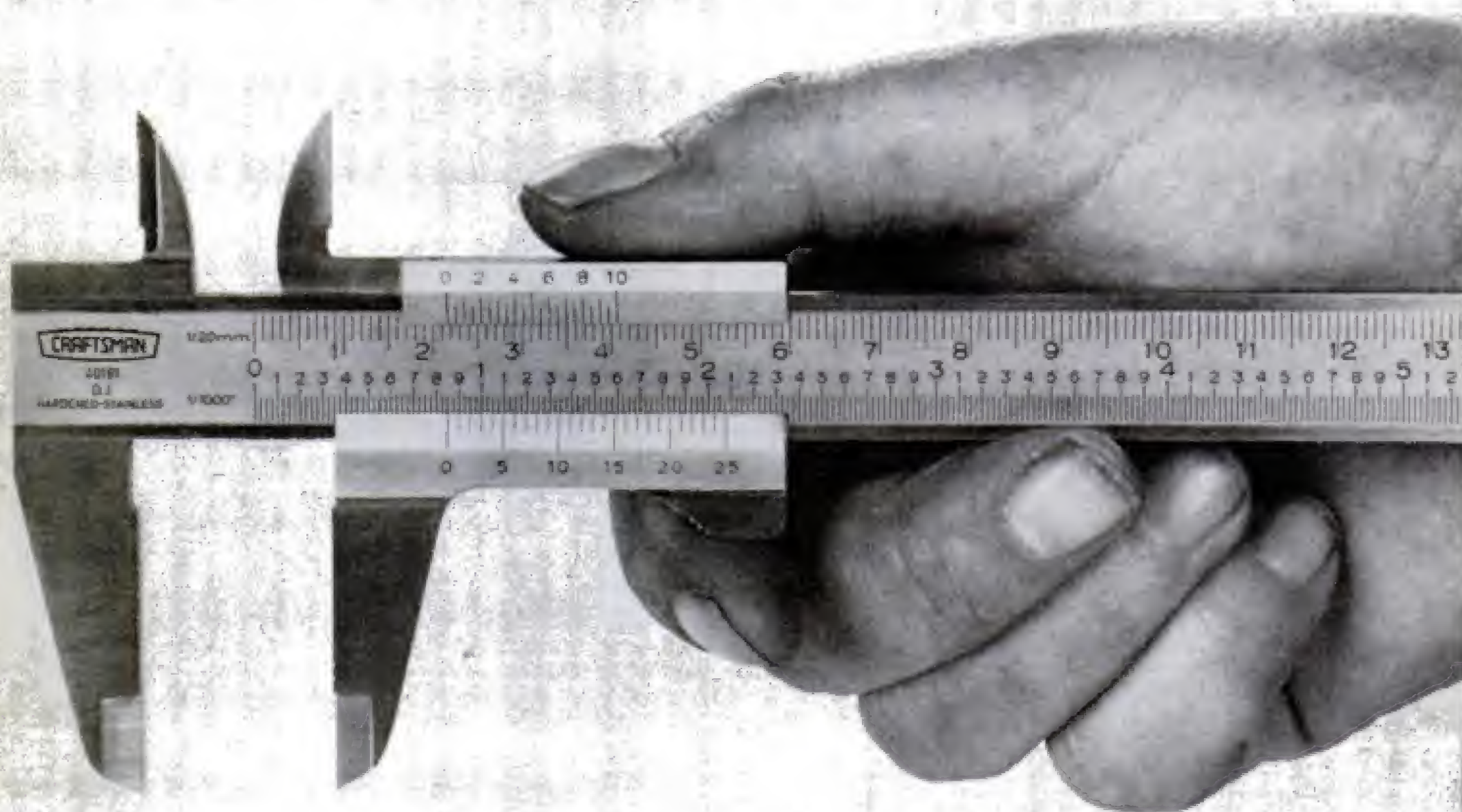
## Custom extensions for wrenches

A useful accessory for a 1/2-in. socket wrench is a 1/2-in.-square steel bar that's been cut into six or seven various lengths. When you need to tighten or remove a bolt in a cramped or awkward-to-reach area, just insert a suitable bar in the socket and use an open-end box wrench to turn the bar, socket and bolt. It's practically the only way to get into tight quarters where a ratchet, crossbar or universal-type extension won't fit (e.g., removing a VW fuel pump).—*H. G. Bennett*





# How to choose and use Small Vernier Calipers



**For real value in an all-purpose measuring tool for precision metalworking, it's hard to beat a 6-in. vernier caliper. What's more, they no longer are extremely expensive**

**By JOHN BURROUGHS**

**A**LTHOUGH MACHINISTS have used them for years, precision vernier calipers have until recently been far too expensive to be known as popular home-workshop tools. But now there's a new class of vernier calipers that is appearing on the commercial market—serviceable 6-in. precision calipers that are competitively priced.

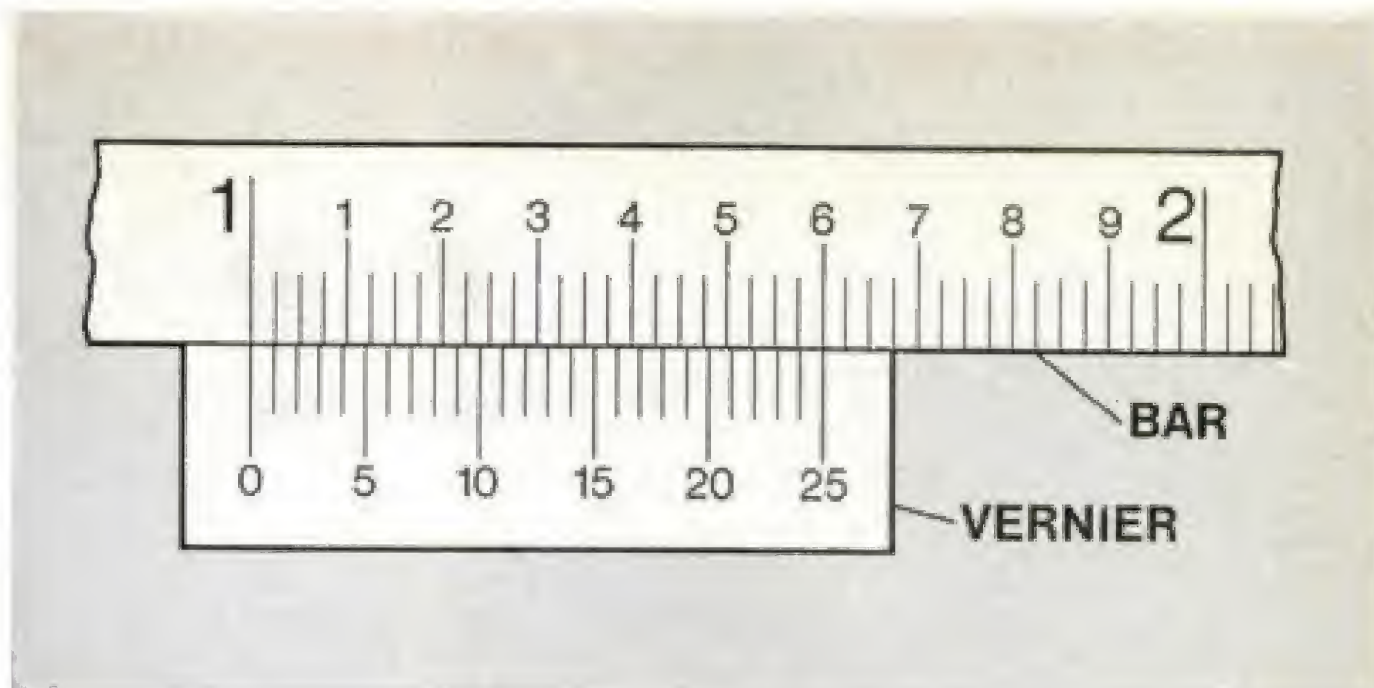
Made in Europe and Japan, these relatively inexpensive calipers are universal-pattern models with scissors-like inside jaws integral with the outside jaws. Selling in the \$14-to-\$20 price range, they're beautifully-finished instruments—hardened stainless steel throughout, with nice-

ly-fitted slides, accurately-lapped jaws and legible satin-chromed photoengraved scales.

The photoengraved scales account for the tools' relatively low prices. Best-quality 6-in. vernier calipers, which cost around \$70, have machine-divided scales engraved on pantograph engraving machines. Photoengraved scales are made by a process similar to that used to make printing plates; that is, they're printed from glass master negatives and then etched. While the etched graduations aren't quite as crisp as the machine-cut graduations, you'd need a magnifying glass to tell the difference. Indeed, for general



**SHORT** 25-division scale often found on older types of calipers is seldom used on newer models. The bar's scale is divided into tenths of inches, with each tenth divided into four parts or fortieths. The vernier subdivides these 1/40-in. graduations into 25 parts, each part being a thousandth



**LONG** 25-division vernier found on most of the new calipers is similar to short vernier, but the vernier graduations are double-spaced to make it easier to take accurate measurements. On the thousandths vernier, reading is .317 in. The top vernier, indicating millimeters, divides metric scale's millimeter into twenty parts. Can you make the equivalent reading in millimeters?



**EXTRA-LONG** 50-division vernier is featured on some newer makes of calipers. The bar scale has numbered tenths, each of which is divided into two parts, or twentieths. The vernier subdivides these 1/20th graduations into 50 parts, or thousandths. The reading shown is .265 inches. The top vernier scale divides the fractional-inch scale divisions (1/16ths.) into eight parts or 1/128ths. What is equivalent fractional reading?



shopwork a photoengraved caliper is completely satisfactory.

Actually it's about the handiest pocket-sized measuring tool imaginable for home-workshop wood and metalworking. When you want a precision measurement, you can use the caliper's vernier to get a reading within a thousandth of an inch. When gnat-whisker accuracy isn't really required—when you're measuring the thickness of lumber, for example—you can forget the vernier and use the tool as a plain slide caliper.

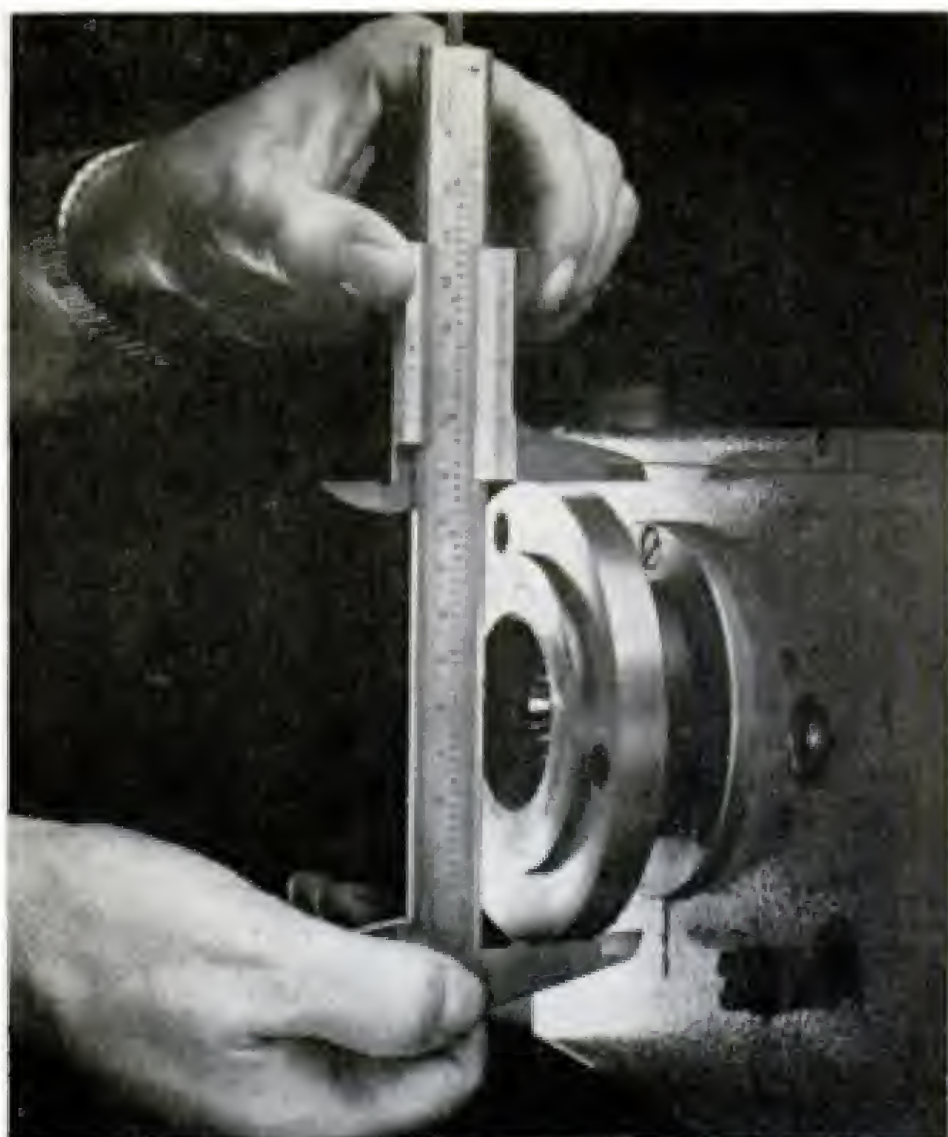
A precision reading takes a little mental arithmetic, but this soon becomes second nature. All verniers are alike in principle.

They're simply auxiliary scales used to subdivide the smallest graduations on the caliper bar's scale into as many parts as there are graduations on the vernier. Thus, you could consider a vernier as just a system of offsets.

#### How to use the vernier

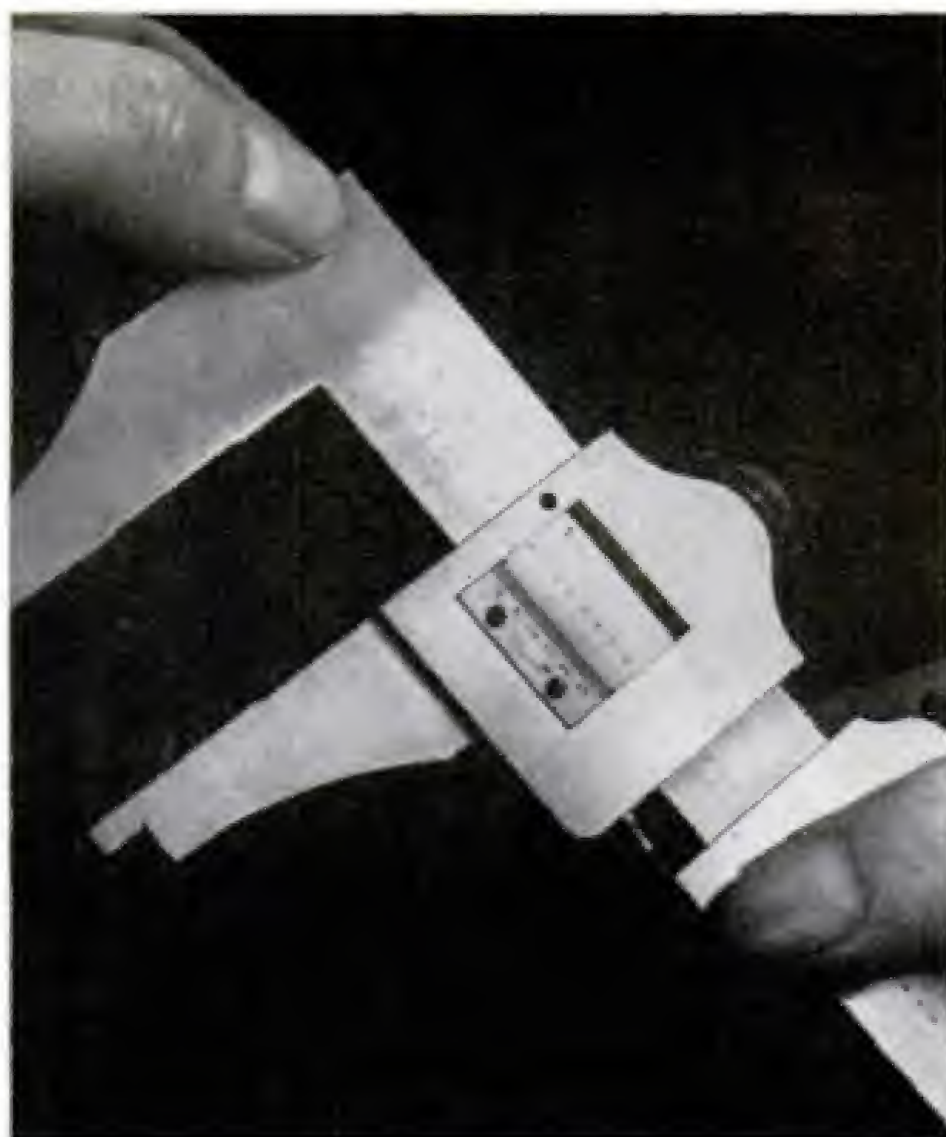
The 25-division verniers used with the decimal-inch scales are 25 thousandths of an inch shorter in total length than the equivalent graduations on the bar scale. This means that with the caliper closed, the vernier's zero-line is aligned with the bar's zero-line, but the vernier's first graduation is offset one thousandth from





**CALIPERS ORDINARILY** are accurate to within one thousandth, more than sufficient for most work

**TO MEASURE DIAMETERS,** hold caliper square with work, take more than one reading for minimal error



**OLDER STYLE CALIPERS** have 25-division verniers only .6 inches long, require use of a magnifying glass

its corresponding line on the scale above; the second graduation is offset two thousandths; the third three thousandths; and so on.

With the caliper opened, the vernier zero-line indicates the measurement to be read. Thus, to read the bar scale, first note the number of whole inches (to the left of this line), then add the tenths of an inch, which are numbered. Next, count the smallest graduations, which are fortieths of an inch, or 25 thousandths each, and add them. Finally, using the vernier, measure and add any fraction of a small graduation remaining.

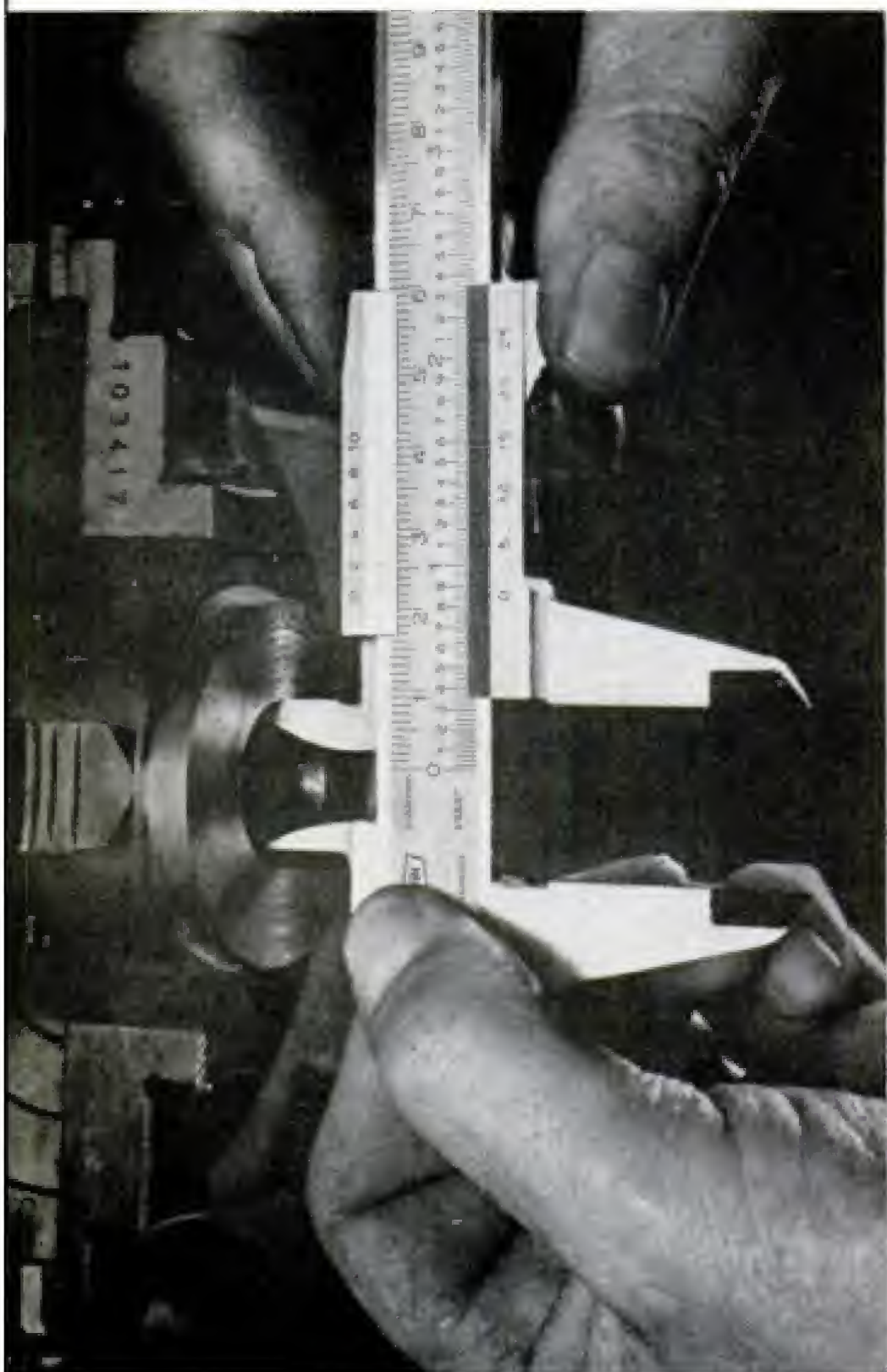
*Measuring this extra fraction* is simply a matter of running your eye along the vernier scale to see which graduation matches a graduation of the bar scale. For example, if the vernier's 17th line matches a line above, the vernier's zero-line is offset  $17/25$ ths of a graduation, or 17 thousandths past the last graduation on the bar scale.

Simply stated, if you think in terms of "whole inches plus 100-thousandths plus 25 thousandths plus thousandths," it's easy to quickly make any reading in thousandths mentally.

### **Special features**

Universal-pattern vernier calipers have two bar scales, upper and lower. The deci-

**POPULAR MECHANICS**







**DEPTHS CAN BE MEASURED** with the sliding jaw or rod on end of caliper beam. Vernier indicates reading



**USE SPECIAL CARE** when measuring hardened-steel cutting tools to prevent damage to the caliper's jaws

mal-inch scale (inches graduated in tenths) is the more frequently used. The other scale may be either metric (centimeters and millimeters) or ordinary fractional-inch (inches graduated in sixteenths).

A metric scale's vernier subdivides the bar scale's millimeters into twentieths or fiftieths. A fractional-inch scale's vernier subdivides the bar scale's sixteenths into eight parts, or 128ths of an inch. On most calipers the two scales have a common zero-line, which permits reading equivalents—thousandths of an inch to millimeters for example.

The slides of some 6-in. models have thumbscrew locks, while others have thumb-released friction locks. Some tools have fixed vernier plates—others have plates that can be adjusted to compensate for jaw wear. There are models with carbide-tipped jaws or fine-adjusting micro-screws.

While a micro-screw caliper is considered preferable for machinework, a tool with a friction lock

**CALIPER JAWS** are lapped until exactly parallel, so they can be used to check if work planes are parallel





# HINTS

FROM READERS



## Lock for hook and eye

Screen doors fitted with a hook and eye often can be opened from the outside by slipping a piece of celluloid between the door and jamb, or a wire through the screw. An easy way to prevent this is to use a turnbutton which will keep the hook in place when turned to a vertical position. This idea also can be used for storm doors and window screens. Just be sure that the turnbutton is screwed down tightly so that it can't slip.



## Eraser finishes metals

The next time you'd like an attractive engine finish on a metal project, chuck a ballpoint pen into the drill press. Its abrasive rubber ink eraser will score neat circular marks in the metal and can be replaced easily when fully worn. Since the body of the pen usually is plastic, be careful not to tighten the chuck excessively or the body will crack. Square off eraser tip first—otherwise it will wear and produce circles with different diameters.



## Lathe chuck on press

Small, finely finished pieces of work sometimes pose a problem when they're to be secured on a drill-press table—they're either too small or too delicate to be clamped in the regular drill-press vise. The solution is a two-piece wooden clamp that holds a lathe chuck on the table. As shown, this clamp has two holes in its sides (for long clamping bolts) and four holes drilled through the top (to fit the slots in the drill press table).

## NEXT MONTH IN SHOP AND CRAFTS

**PM BUILDS A JOGGING MACHINE.** Keeping fit nowadays usually takes the form of jogging—and with *PM*'s jogger/walker, you won't have to forego a daily session because of inclement weather. To see this neat-looking unit in color, and to learn how you can build one like it for about \$30, don't miss the June issue.

**ARE LOW-COST WELDERS ANY GOOD?** In response to a number of inquiries about the performance of low-cost, 110-v.a.c. welders, *PM* turned the assignment over to John Burroughs, top shop contributor. For the results of his tests—and some noteworthy tips on how to use one of these induction-type welders—watch your newsstand for the June *PM*.

**HOW TO COLOR CONCRETE.** Your next concrete project can be as colorful as you want, now that a number of materials and methods can be used to avoid a vast expanse of drab gray. For the complete story on how to use which material, next month's story is required reading.

**BUILD THIS ONE-MAN GOLF CART.** This nifty little three-wheel vehicle beats lugging a heavy bag. A quick take-apart design lets you tote it to the golf course in the trunk of your car. An oversize muffler keeps its 3-hp gas engine purring quietly, and it can be built from easily obtainable parts. Look for it in the June issue.



# With an option list like ours we ought to have taller windows



But we'd rather give you more choices than anybody else in the business

If you need a V-8 engine in your SCOUT®, you aren't going to settle for a four. We offer you both . . . and a brand new high-output six, to boot.

If you want a smooth automatic transmission, a three-speed stickshift won't do. So we offer you both . . . plus a four-on-the-floor with a super low "granny gear" for the really heavy going.

You can have a cab top or a full length wagon top, five seating arrangements including buckets,

7 colors (some metallic), color-keyed interiors, flotation tires, hub caps or fancy wheel discs, painted or chrome bumpers.

Plain or fancy . . . dolled up or calmed down . . . pleasure or performance, the most exciting do-it-yourself project you ever tackled is waiting for you at your INTERNATIONAL® SCOUT Dealer.

**IH** INTERNATIONAL HARVESTER COMPANY  
CHICAGO, ILLINOIS 60611

## The do-it-yourself Scout.



# WE'D LIKE TO MAKE VARMINT SHOOTERS.

## Here's a guide to picking precisely the right Remington rifle in the right caliber for your kind of varminting.

This year Remington offers you a choice of thirty-one rifle and caliber variations that are specially geared to varmint shooting.

Why so many? Because it's a big country. With different kinds of varmints, different kinds of terrain, different shooting conditions.

Another thing, not everybody is ready to invest the same amount of money in a varmint rifle. So our prices start way down at \$89.95\* for the Model 788 and wind up at \$334.95 for the Model 700 Custom...with plenty of prices in between.

### Where and how will you shoot?

Your first consideration is the type of country your varmint safari will cover. If there's room to reach out 500 yards, then you'll want one of the hotter cartridges. However, if your varmint haven is broken up with stone fences or hedgerows about 100 yards apart, a milder cartridge should be ample.

For shots up to 250 yards, the 222 Rem. is a very good choice. If you



want to reach out to about 400 yards, we recommend the 22-250 Rem. Two other good long-range choices are the 6mm Rem. and the 243, which, with heavier bullets, are also suitable for bigger game such as white-tailed deer. (Our tests with varmint loads give the 6mm a slight edge in accuracy over the 243.)

Also important is how far you plan to carry your rifle on foot. If you're in a location where you can practically (and legally) stalk your varmints on gasoline-powered wheels, the weight of your rifle doesn't make too much difference. But if you have to hoof it and you're not as young as you used to be, then you might think twice about acquiring a rifle-and-scope combination that might scale ten pounds.

### Here's the rundown.

We thought you'd like a complete rundown of the 1969 Remington varmint entries as a sort of guide. Of course, you don't have to agree with us 100%. There's always a degree of personal preference involved. However, so many of our Remington people are such ardent varminters, we can give you a majority opinion.

**Model 788—top accuracy and power, near bottom price.** This Rem-

ington series was introduced last year, mostly in big-game calibers. Now it is available in four varmint calibers—222 Rem., 22-250 Rem., 243 and 6mm Rem. (Left-hand version available in 6mm Rem. or 308.) Outstanding feature of the 788 is pinpoint accuracy that puts many an expensive target rifle to shame. Nine heavy locking lugs for solid breeching and the fastest lock time on a center fire rifle. Weight runs about 7½ lbs. A wonderful way to get into varmint shooting with a top-drawer rifle at moderate cost...from \$89.95.

**Model 660 Varmint Carbine.** There's no reason why you can't shoot an eastern chuck with this 20" barreled carbine. But it really comes into its own in a western saddle scabbard or car rack. On the other hand, its light weight is making it popular with field hunters from



Model 660 Carbine



# LIFE SIMPLER FOR



Model 788

coast to coast. Available in three basic varmint calibers—222 Rem., 6mm Rem. and 243.

The 660 is a good choice in any caliber if you do any reloading. The bolt is the strongest made, and when it is closed, the cartridge is surrounded by three rings of steel. And there's a special barrel bracket for rugged 'scope mounting. Prices start at \$119.95.

**Remington Model 700**—the old reliable of the Remington varmint line... designed and built for minimum target, maximum range, precision shooting. The barrel is longer—up to 24". So the weight goes up a bit to around 7 pounds. But here's a rifle that's not too heavy for field carrying and that a rifleman can really hold on target. (Actually, in the big-game calibers, it's considered as a light- or moderate-weight arm.) Available in varmint calibers: 222 Rem., 22-250 Rem., 243 and 6mm Rem.

We can't think of a place in the entire country where a varmint shooter carrying a Model 700 wouldn't be instantly tagged as a guy who knew his varmints—and his rifles. (It's a top choice among handloaders.) The finish, both metal and wood, on a 700 is something to make you want to stroke it like a Persian cat. Everything on it looks and feels expensive except the price. In varmint calibers from \$134.95.

**The Model 700 Varmint Special.** This king of varmint rifles comes equipped with a 24" heavy barrel, which raises both its weight and its price. Nine pounds and \$169.95. However, that straight, solid barrel is less affected by heat, stock pressures and sling tension. It puts shot after shot right into the kind of groups that make rifleman drool. We don't bother to put iron sights on the Special. Simply because we know you'll equip it with the biggest, highest-powered, sassiest 'scope this side of Mount Palomar Observatory. Same varmint calibers as the regular 700 except we added the 223 Rem. It's been said that a rifle is only as good as its ammo. So we've developed...

Varmint bullets for varmint accuracy. Remington-Peters cartridges in varmint calibers from 222 Rem. up through 6mm Rem. are loaded with a very special bullet. A unique process of manufacturing produces a perfectly balanced concentric bullet that just doesn't stray off course. Shooters tell us that this accuracy actually cuts group sizes in half. The bullet has a hollow point and nose cuts to insure devastating expansion on varmint targets. Look for the name "Power-Lokt"® on the Remington-Peters boxes. (Yes, handloaders, you can get "Power-Lokt"® bullets to top off your pet handloads.)

**We do hope** that this information about Remington varmint rifles and ammo has helped you. We would also like to send you our catalog which shows more pictures and gives detailed information for which there just isn't room here. Write Remington Arms Company, Inc., Bridgeport, Conn. 06602—Dept. E5



"Power-Lokt" varmint bullet

Model 700 Varmint Special

Model 700

**Remington DU PONT PETERS**

Remington, Peters and "Power-Lokt" are Reg. U.S. Pat. Off.  
\*Fair Trade prices in states having Fair Trade laws.



## THOSE LITTLE TRACTORS!

*(Continued from page 145)*

who may put on 1000 hours a year.

"We must try to strike the balance that will give the improvements needed for commercial use," says Igor Kamlukin, Simplicity's chief engineer, "while keeping the tractor priced for the average buyer. The result is a vastly different machine than we had eight years ago. And the average buyer reaps the benefit. If the tractor is equal to commercial applications, it's a wonderful unit for the homeowner."

We asked Kamlukin for an example of how testing influenced design.

"Take our hydrostatic tractor. We built a prototype unit using the elements our competitors were using. We were told that if we had a cooling fan of the same proportion we'd be all right. We ran our unit under load, and our temperatures were running high. We compared our results with what competitors considered satisfactory and decided we couldn't live with them. We didn't want to tell a customer who bought our most expensive machine that he could use it for mowing but not for heavy work. We cooled the transmission in such a way that we could absorb the full power of the engine through the rear wheels.

"We tested our unit with a drawbar pull of 850 pounds at full engine speed without overheating. We increased the load until the engine lugged down and stalled. Still we did not overheat. We had accomplished what we wanted to do. Our reason for demanding more is that our tractors get into the hands of contractors. We have to build for the roughest use and still stay competitive."

At Bolens, Port Washington, Wis., a project manager is given full responsibility for the development of a new tractor.

"We keep the same project engineer on a new model for its entire life," says Dave Phillips, chief engineer. "He has a personal stake and pride in it. He designs and tests it, follows it through production and makes modifications."

How much time goes into development testing?

"About three years went into developing the hydrostatic transmission for our new 7-hp model," Phillips says. "Our 12-hp hydrostatic went through four-and-a-half years of testing before it went into production. One of the most challenging problems was developing a foot control for the hydrostatic. By driving cars people have been educated to think with their feet, so we wanted a responsive toe-and-heel control—toe down for for-

ward; heel down for reverse. This would leave the operator's hands free for steering and handling attachment controls. We tested and abused these controls until we were satisfied that they were dependable and safe and took full advantage of what hydrostatic offers—quick maneuvering in tight quarters."

At the 400-acre International Harvester Research and Engineering center, Hinsdale, Ill., Cub Cadets run the same obstacle course used by International's 140-hp giants and are tested in the same labs.

"We build garden tractors," says test engineer Dick Coleman, "to do the jobs for which they were designed for the length of time we have established in our original goal. That means in the neighborhood of 150 hours of continuous heavy-duty use before any major repairs should be necessary. Even then we don't mean complete failure. You may expect a bearing to deteriorate, but not all bearings or gear teeth to fail. We might expect what we call 'class three' parts—those that should be replaced on inspection because they show deterioration. But 150 hours of our continuous full-load running is the equivalent of 5 to 10 years of use by the average owner."

"We don't qualify our 12-month warranty," says Jim Reed, specialist on lawn and garden equipment. "It's 12 months whether it's homeowner or commercial usage. Some of our seven-year-old tractors need only a minor tune-up and a new mower to put them back in shape."

Because it was first in the industry to offer a two-year warranty on tractors and mowing equipment, Wheelhorse, South Bend, Ind., believes that this attests to the thoroughness of its field testing.

"The average customer realizes that there's always the possibility of some minor failure of a machine, no matter how good it is," says Jim Barnes, manager of testing. "As important as quality is quick service on parts and repairs. Our testing minimizes failures, but it also minimizes delay in correcting problems because we have isolated the cause and can speed replacements to customers."

"Despite careful checks, occasionally something gets past us that stumps us for a while," says Jack Rose, chief project engineer of Massey-Ferguson at Detroit, Mich. "We once had a rash of battery problems. After some digging we discovered that the supplier had one worker on his line who was doing things his own way and every battery he made was bad. Until we found the cause, we couldn't risk shipping defective replacements."

"We have a rectification program to  
*(Please turn to page 202)*





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"The bigger the glass, the better the Bud. Shorty up there just won't do."

**Budweiser is the King of Beers.**

(But you know that.)



## THOSE LITTLE TRACTORS!

*(Continued from page 200)*

correct any major problems in the field. If it's a serious problem, we go out to the customer. If necessary, we'll send a mechanic to correct every machine."

We're careful to fight company patriotism—the idea that if it's painted our color it's perfect," said William Schlapman, president of the Winneconne, Wis., division of J. I. Case. "Like everyone else, we goof occasionally, but we make good. In '66 the kingpins on our front axles weren't hardened. Engineers believed that the cold-rolled steel that was used with the cast-iron front-axle housing and the lubricant would function properly. It didn't. As soon as we discovered this, we heat-treated the kingpins; this prevented the galling of the cast iron. We had a field campaign to replace this part. We instructed dealers to make the repair and we underwrote the entire cost. However, only 0.65 percent of all our tractors sold in the last 12 months had claims filed against them for warranty service or replacements. Only \$3.85 per tractor was paid in claims. This includes parts at dealer's cost and labor at local rates."

At Ariens, Brillion, Wis., as each tractor reaches the end of the production line it is load-tested and tuned on a dynamometer.

"We don't sample the line; every tractor is run in," emphasizes Ariens' Jim Youngworth. "Our engine supplier has already run every engine; we dynamometer-test it again and tune it under load."

"Field-testing gets the emphasis at Ariens. What a customer can do to a machine and what you can do to it in the lab are two different things!" says Youngworth.

"We do a lot of laboratory testing," says Kenneth Finden, chief engineer at Toro, Minneapolis, "but our evaluation and long-term durability testing is done in the field. Our units are mowing 13 hours a day—and in California in the winter. We test snowthrower attachments in the Canadian Rockies where we get altitude and wide variations of temperature. In the cold room of our lab we can simulate temperatures, but we can't as yet duplicate all snow conditions."

"It's how the product performs in actual operation that counts. We could spend thousands more on fancy lab equipment, but if a little old lady in Dubuque uses your product and finds some glaring error you didn't catch in the lab, it can be very embarrassing. That's why we put most of our effort on field testing."

At Lexington, S.C., we asked the man-

ager of engineering for the Outdoor Products Division of Allis Chalmers, L. R. McGrath, why tractor makers are continually testing mower attachments.

"Every new mower model is different," he said. "It may have a different length of blade, or operate at a slightly different speed, or the clearance between the blade and the housing may have been changed. All these factors affect performance. And every new model must be tested to meet American Standards Assn. safety specifications. We won't release a mower that won't do a quality job. That requires constant testing." ★★★

## ADD A SCREENED PORCH

*(Continued from page 174)*

ing 3/4-in. plywood to the rafters and 3/8-in. plywood to the joists. Follow this by covering the roof with tar paper, then with a metal flashing where the new roof meets the old and, finally, with shingles to match the house. All that's left is to install the 4x4 lintel and its supporting 4x4 posts before filling in the ends of the porch roof and adding a 1x8 fascia board across the front and up the ends.

### Making the screens

The number and size of frames you need to enclose your porch is determined from the porch itself. If you've planned for 8 ft. between posts, then all screens across the front can be made 48 in. wide. The drawing on page 174 shows how the screen frames are made from common 1 1/8-in. screen stock. Note how members are half-lapped for extra strength.

You have a choice of installing the frames permanently in place or fitting them so they can be lifted out and stored for the winter. In the latter case, door bolts are added to the bottom rails to engage holes drilled in the slab. Quarter-round molding nailed to the posts and lintel makes the screens fit bug-tight. Drain notches should be provided along the bottoms of the screens, and if screens are permanently installed, pick copper wire or aluminum, or one of the new plastic screening materials, to cover them.

The door opening in the end of the porch is framed with 2x4s which are anchored to the slab and the joist with angle brackets. You can buy a stock door as cheaply as you can make one. The area which surrounds the doorway is fitted with individual screens.

As the summer goes by you'll enjoy your porch more and more. You'll find it one of the best investments you can make for a small home. ★★★



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\*Craftsman Mowers are guaranteed for one full year from date of sale. If repairs or repair parts are required for proper performance, they will be furnished at no cost. Normal maintenance tuneups, blade sharpening, cleaning, and failures which are a result of abuse are not included in this coverage.



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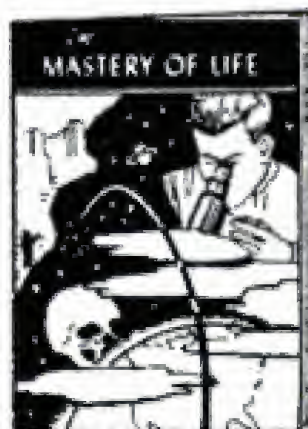
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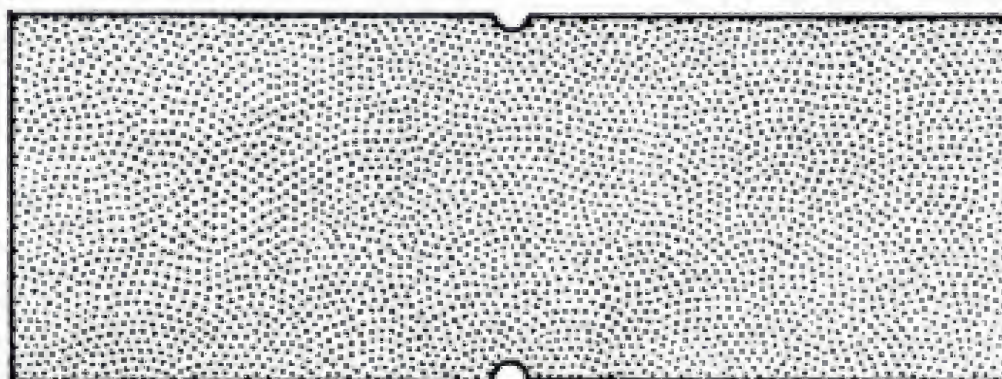
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## THOSE FAST, NEW TRAINS

(Continued from page 99)

Central (whose first move after the merger of the Pennsylvania and New York Central was to try to buy into the clothing business) and the U. S. Government, we don't care enough any more to have a first-class, passenger-hauling railroad. Maybe it's like building a streamlined stage coach after the Golden Spike was driven—100 years ago this very month. For 80 years after that, passenger trains in this country got faster and faster, cleaner and cleaner, more and more luxurious. Then with the advent of jet airplanes and interstate turnpikes they went to pot. The Pennsylvania, which carried 130,000 passengers a day between Washington and New York in 1946, carried less than a third that many last year. Obviously, it wasn't all the railroads' fault.

With the highways filling up and the airlines becoming more and more congested and unreliable on short runs, putting more people back on the rails seems like a logical, almost imperative move.

### Rails make the difference

The stumbling block that neither the government nor the railroads has been willing to face is, "Can you put them back on the same old rails?"

The Canadian National tried it and had to limit its Turbotrains, capable of 170 mph, to a maximum of 95. The Penn Central which laid 312 miles of welded rail (on 452 miles of double track), lets its 160-mph Metroliners out to 110 mph for short distances.

In Japan, the NTL goes 132 mph nearly all of the way, because it runs on an all-new railroad. The welded rails are nearly a mile long. The ties are concrete. There are no freight trains to beat down the roadbed, and there is not a single grade crossing between Tokyo and Osaka. There are still 20 on the Metroliner's route and 300 on the CN between Montreal and Toronto. Sure enough, the Turbotrain hit a truck on one of them the first day. The Metroliner fared better. All it did was suck the windows out of an old train as it passed.

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the Turbo as a train that could run at high speeds on existing roadbeds. To accomplish this, the cars are suspended to swing inward on curves and the wheels are "steered" instead of depending entirely on flanges to get them through the curves.

The Turbo makes it around the curves, but on some of them at 95 mph the passengers are hanging on.

On the NTL I placed a cup of coffee on the window sill. At 132 mph it didn't slosh a drop. On the Turbo, a pretty hostess serving lunch, airline style, poured me a glass of wine and set the bottle on my tray. Before she turned her back it was all over my lap.

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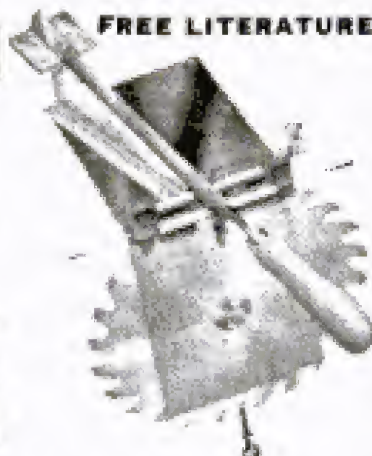
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## HOW YOU LOOK TO A TRUCKER

(Continued from page 97)

drivers, sitting much higher, get blinded by your brights long before car drivers do. "You don't get the glare as soon," says Padgett. "It helps to lower your beams even when a truck's a mile away."

We have a hot dinner at a Jesup, Ga., gas stop, then get in No. 1914 with Yates Webb. Copilot Hillard Wise is snoring in the bunk, curtains pulled. We're on two-way US 1 in dark pinewoods when we begin having trouble with a driver ahead. Our speed drops to 48. In our headlights is the rear of a great, shabby truck. No name. "Must be an illegal load. He's taking no chances on a ticket," Webb says.

At last there's a place to pass. Webb boosts speed and pulls out. The other truck speeds up. Then comes a long no-pass zone. And the guy ahead slows down!

We try again. Same story. "He isn't giving me a break," says Webb. For awhile he watches the other truck. One of its taillights keeps going out. Webb tries again, coaxing the needle up to 58.

"He's sure giving me a hard time," says Webb. "He must have three pills under his belt. That's your goofball driver."

Cars from Kansas, Maine, New York whirl by us. They pass but we can't. It's 9:37 before we come to a safe two-mile straight and Webb at last commits our 34 tons to another attempt. Our speed is 55. The goofball goes to 56. Webb goes to 56. The goof goes to 57. Webb puts us at 57, then coaxes the new engine to 58.

Suddenly we're neck and neck. And the Cummins diesel is roaring. A fast-overtaking truck always pushes wind ahead. But on the sides it pushes a back-blast—a strong drag force. In the next lane it's like a hand pushing you back. And now our back-blast seems to take hold of the goofball. Slowly we push ahead.

He keeps trying hard. But our new Cummins, feeling its oats, is actually dragging him back. Our speed goes to 59. Headlights appear far ahead. Now we've got to get back in. Webb gives the engine everything. We pull ahead—at 60 mph!

And suddenly, we're back in line with plenty to spare. Webb shakes his head. "You see, we have trouble with some drivers, too. That guy sure was on pills. But most of us don't act like that. After all, we're all car drivers, too!"

Fourteen minutes before midnight we throb into Jacksonville terminal. Webb, uniform still fresh, swings down for coffee, and No. 1916 rolls in. I take leave of them here. By midnight Yates Webb and pals thunder out for Miami, another 350 miles, with all those Yankee gravestones. ★★



## THOSE FAST, NEW TRAINS

(Continued from page 99)

Central (whose first move after the merger of the Pennsylvania and New York Central was to try to buy into the clothing business) and the U. S. Government, we don't care enough any more to have a first-class, passenger-hauling railroad. Maybe it's like building a streamlined stage coach after the Golden Spike was driven—100 years ago this very month. For 80 years after that, passenger trains in this country got faster and faster, cleaner and cleaner, more and more luxurious. Then with the advent of jet airplanes and interstate turnpikes they went to pot. The Pennsylvania, which carried 130,000 passengers a day between Washington and New York in 1946, carried less than a third that many last year. Obviously, it wasn't all the railroads' fault.

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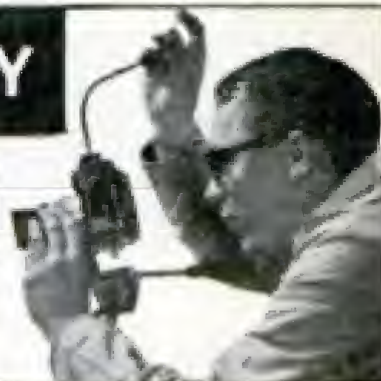
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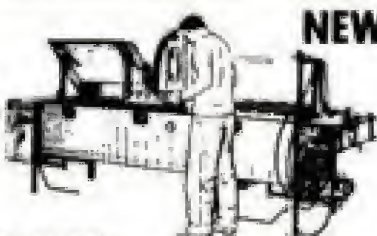
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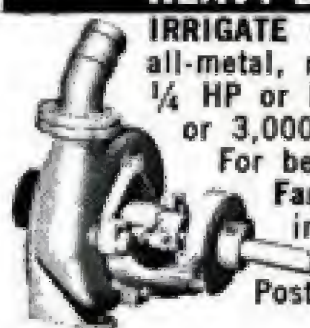
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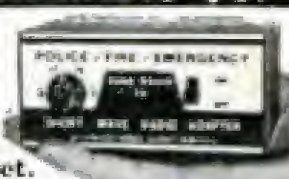
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(Continued from page 117)

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Bede will also have new engines available of 108 to 200 hp, but these are not included in the basic price of \$2940 for the complete airplane package. So the final price will probably average about \$3500.

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Obviously, most of these parts—except the wings—are readily available as stock items, and many builders would prefer to scrounge for them on their own. However, Bede claims he can save them 15 percent on the seven complete packages over what the items, purchased individually, would cost. And he is quite willing to sell you the individual items—at regular prices—without packaging them. The packages are not only a convenience and a savings, but Bede's way of saying, "Here is all you need for this section of the airplane."

There are few "family size" experimental planes around, and, if you've been looking for something more than a one-seat, weekend runabout, this may be it. Bede recommends two seats for engines of from 108 to 140 hp, and four seats for engines from 150 to 200 hp.

Also, it may be one of the sturdiest and safest of all the homebuilts. In spite of its respectable cruising speeds, it would win few pylon races or aerobatic contests.

Finally, and probably most important, it is surely one of the easiest to build of all homebuilts—almost foolproof, in fact. From the instructions—written by Bede himself—and crystal-clear plans, plus the easy availability of every nut and bolt necessary from Bede himself, it could be as simple as number painting.

What's the sum-up? I think it's one of the most professional of all amateur aircraft, and one that will wear better as you and it grow old together. ★★★



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## NEW CAMPER . . . NEW PARK

(Continued from page 127)

will not dry out overnight. Bedding feels clammy. Coats, suspended from hangers, still aren't dry. A tent wouldn't have a chance, except in summer.

But I am using a coach. I like the way the El Dorado coach handles on the highway. Pitch and yaw over chuckholes is missing. Nor does it sway, rock or wobble in hard winds. Careful loading of our gear keeps the center of balance nearly unchanged. The El Dorado earns very high ratings for overall highway stability. No tail-end sag is visible during any highway test. The interior is adequately insulated, bright and attractive, and convenient for dining, sleeping, or relaxing. I picked the nine-foot Comanche because it seems to condense all the features of big coaches into one of modest weight and somewhat shorter overall length. It is ideal for a family of three to five persons.

Though the coach design is good, there are some new-unit problems which plague us for several days. The roof leaks badly, allowing water to pour in through a forgotten seal around one top-mounted vent. It is repaired easily and quickly. The rear door will not stay in adjustment and frequently pops open during rough-road travel. The icebox drain hose will not stay in place. As soon as the ice melts, water fills the icebox floor pan then runs down the walls when the box door is opened.

Our ¾-ton Ford pickup is equipped just the way I like it for carrying a camper coach. The heavy-duty camper-package equipment provides about 3500 pounds of payload capacity. Since our total coach, gear and passenger load brings the street-weight up to 7000 pounds, there's a comfortable 500 to 600 pounds of safety factor at all times. Yet, despite this load, the big 390-cu.-in. V8 handles the situation without problems. Load-starting power is excellent. Acceleration is good, considering the weight involved. And even at 55 to 65-mph cruising speeds the Cruise-O-Matic kicks into passing gear without hesitation. There's no engine overheating at any time. The big engine runs smoothly, without pinging, on the cheapest grades of regular gasoline. Average fuel consumption with our 7000-pound load is about 10 mpg on the flats and about 9 mpg in the hills.

On the truck itself, I find the lack of a night light on the shift-panel bothersome. And the two-way switchover valve for the reserve fuel tank is in an awkward position to turn the valve rapidly.

The new Redwood National Park may be the last great act of conservation of our time. Go see it. ★ ★ ★

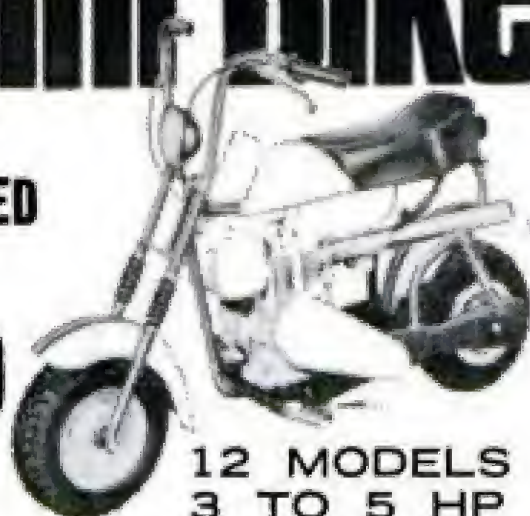


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reminding technicians that all objects placed aboard or removed had to be weighed. Later, I mentioned this to Dr. Piccard. "We must have an exact record," he said, "of the boat's weight, in order to calculate the ballast. If the submarine is one pound too light, we will never be able to sink. If we are one pound too heavy, we will never come up."

He explained that the submarine is designed to "float" at any depth down to its 2000-foot limit without pumping water in or out of the ballast tanks. This is because the submarine's pressure hull is less compressible than water.

All conventional submarines, including nuclear subs, are more compressible than water. That means that as the sub descends, its hull is squeezed to slightly smaller volume by sea pressure. Not much can be done about this in a military submarine, Dr. Piccard said, because the weight of equipment and armament limits the weight, and therefore the rigidity, of the pressure hull. Of course a nuclear sub, with virtually unlimited power, can "hover" by pumping ballast, or use its motor to "fly" at a desired depth. But in a research submarine weight can be carefully regulated in relation to the size and stiffness of the hull to create a design that can be balanced to neutral density at a wide range of depths. (A pound of water added or subtracted makes the *Ben Franklin* descend or rise exactly 10 feet.) This is what makes the Gulf Stream drift possible; otherwise the power available would limit how long the sub could stay down.

## Hull construction remarkable

The *Franklin's* pressure hull alone is a wondrous job of engineering. It was fabricated by bending and welding together 20 massive pieces of steel—six cylindrical sections and the two hemispheres, each made of seven segments. These were reinforced with 16 welded stiffening rings. Cast-steel reinforcement plates were added wherever there were portholes or penetrations for electrical cables or piping. A variety of clips, brackets and attachment points, designed to support equipment inside and outside, were welded in place. In all, 1000 items were welded into the hull.

All that welding introduced stresses. These were relieved by cooking the entire hull in a giant electric oven at almost 1000°F. for several days and letting it cool slowly. Then all the welds were X-rayed and tested ultrasonically, and the hull was measured all over to make sure

nothing was out of line more than about  $\frac{3}{8}$  inch. So careful was the work that no imperfections were found by an American Bureau of Shipping inspector. The hull's collapse depth is 4000 feet.

The hull is in two pieces bolted together at a flange joint aft of amidships. The forward section contains all controls, electrical gear, galley, head and shower. The after section contains five of the six bunks, workbenches and space for scientific equipment. It can be removed and a new one bolted in place for a different sort of mission. This might be, for example, a lock-out diving chamber that can be pressurized while the forward section remains at sea-level pressure.

Aside from the hull, electrical equipment constitutes the heaviest part of the *Ben Franklin*. The 378 batteries make up close to 25 percent of the sub's weight. It was logical to place them in the keel, where their weight keeps the sub upright. In this free-flooding section, the batteries must be sealed against seawater, yet able to release hydrogen gas given off during operation. That's done in smaller research subs by encasing the batteries in an oil bath. To save weight, the *Franklin's* batteries are vented through a manifold of oil-filled tubes leading to a single duckbill valve.

Battery power, totaling 756 kilowatt-hours, is available in four different voltages: 168 volts for the motors that swivel the main propulsion motors, 336 volts for the main motors, 112 volts for the lamps that light up the sea around the *Franklin*—70 powerful searchlights—and 28 volts for on-board equipment. The sub's motors, running on a.c. for better control, require inverters and switching gear that take up a good deal of space.

The four motors provide a top speed of five knots, but are intended for maneuverability, rather than speed. Since they can be pointed forward or back, up or down, the sub can turn or tilt every which way. During the mission the motors will be used mostly to get back into the mainstream if the *Franklin* should drift into one of the Gulf Stream's branches. Here's what the mission will be like, as far as Dr. Piccard can visualize it beforehand.

The *Ben Franklin* will be towed out to sea with her crew aboard, said Dr. Piccard. The western edge of the great current is only a mile offshore near Palm Beach, so the tow will be short—fortunately, since the sub's surface behavior is less than ideal. Aboard will be Piccard, Kazimir and Erwin Aebersold, a Swiss associate of Piccard's, as pilot. Three U.S. Navy scientists will be headed by Frank

(Please turn to page 214)



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## FROM FLORIDA TO CAPE COD

(Continued from page 212)

Busby of the Naval Oceanographic Office.

After hatches have been sealed and final checkout performed, the sub will submerge. First will come complete flooding of the "soft" fiberglass ballast tanks, which provide surface flotation. Next, a carefully calculated amount of water will be let into the two "hard" (pressure-resistant) ballast tanks in the keel which hold about 100 gallons.

The dive will be slow. After a gradual descent, during which ballast will probably be pumped to arrive at approximately the right depth, an even slower settling will take place as the sub cools off to the temperature of the water. It's expected that 24 hours will elapse before the *Franklin* finishes contracting as it cools and reaches a state of neutral buoyancy.

Since the water here is of continental-shelf depth—a few hundred feet offshore, gently sloping out to sea—during the first half of the mission the sub will be drifting at fairly shallow depths—300 to 600 feet. Several excursions to the bottom will be made to take pictures of undersea topography. The sub will be equipped for 35-mm movie-making and still photography. The excursions will take place during the first half of the trip, because north of Cape Hatteras the Gulf Stream veers off over a bottom more than 10,000 feet deep.

Piccard plans to stay close to the west wall of the Gulf Stream. Since the water temperature in the current increases to the east, he could conceivably navigate by monitoring the temperature and periodically adjusting position to the desired temperature line. But this would not provide position data accurate enough for scientific measurements. For that data, the sub will rely on two surface ships supplied by the Navy, and contact them by means of a sound-powered underwater telephone.

The men aboard the sub will be able to deliver items to the surface. A small airlock in the top of the hull is designed for release of five-inch aluminum spheres in which rolls of film, tape cartridges, written notes or small specimens of marine life can pop to the surface.

### Daily drift 36 to 48 miles

Drifting with the current, the *Franklin* will average 1.5 to 2 knots, and make 36 to 48 nautical miles a day. At the surface, the Gulf Stream has an average speed of 4 knots. This means that the surface ships, in order to remain above the sub, will travel 1500 miles northward by steaming south.

"Our life on board will be relatively comfortable," says Piccard. "Each man has his own bunk. There is a roomy wardroom forward, where a game of gin rummy can be enjoyed. And we will have a fresh-water shower, washing and toilet facilities." Considerable intelligence has been devoted to life-support systems that are foolproof and use practically no electric power.

### Cooking water stored near boiling

Food will be the freeze-dried variety, "cooked" by adding hot water. To avoid using power to heat it, the hot water—some 190 gallons—is carried in "super-insulated" tanks designed to keep it just below boiling for the whole month. The superinsulation—a vacuum jacket surrounded by layers of aluminized mylar film—was developed originally for the Apollo lunar spacecraft.

Another 380 gallons of water is aboard for drinking, washing and toilet-flushing—over two gallons per man per day. Waste water cannot be pumped overboard. That would reduce the sub's weight and make it rise. So well-sealed waste tanks are provided.

Due to the long duration of the voyage, unusual attention had to be paid to control of odors and poisonous fumes from electrical and lab equipment as well as from humans. Forty different gas-detector tubes will identify contaminants in the atmosphere, and a catalytic burner will dispose of what activated charcoal won't remove. Breathing atmosphere is supplied by a surprisingly simple system—two standard industrial Thermos-bottle-type tanks of liquid oxygen, to be vaporized and metered automatically, plus trays of lithium hydroxide for carbon-dioxide removal.

Heating is not expected to be necessary. Since the surrounding water temperature will be about 61°F., heat generated by machinery and crew will keep the cabin temperature between 63° and 81°.

Barring any emergency, the scientists should have ample opportunity to study the marine scene through the portholes. Unlike many research subs, the *Franklin* is not equipped with a claw for taking samples. It does have one unique sampling device, a quartz tube connecting two of the rear portholes. Equipped with valves, it permits small quantities of water to be brought inside the sub, where small marine life can be studied under the microscope at depth pressure. They can then be allowed to swim out or be added to the biologist's collection.

A form of marine life Piccard hopes to study, he said, is what is known to ocean-



ographers as the "deep scattering layer." This shows up on sonar scopes as a false bottom at depths down to several thousand feet. The DSL is thought to consist of shrimplike creatures or small fish; it moves up toward the surface at night, presumably in response to darkness. Many attempts have been made to sample the organisms, with confusing results. Piccard believes the *Franklin* is the ideal tool for study of the DSL—it can spot the layer on sonar from below or above, place itself right in the layer, and follow the slow rise and fall of the layer through its 24-hour cycle.

The submarine is also ideally suited to study ocean sounds, since most of the time she will be drifting with motors and noise-making gear shut down. Tape recorders will capture the grunts, chirps and clicks that fish make, and the dull grating of the water over the sandy bottom. The sub will also study underwater sound transmission, a fascinating subject for the Navy.

If all goes well, the mission will be terminated when about 80 percent of battery power has been used. The *Franklin* should then be 100 to 250 miles off Cape Cod. The procedure for coming up, if nobody's in a rush, is the opposite of going down: Blow water out of the ballast tanks with compressed air.

### Steel shot speeds surfacing

The sub also carries over six tons of steel shot that can be dumped to bring her to the surface in a hurry. The shot is held in two hoppers by electromagnetic "valves." A steel ring at the mouth of each hopper is permanently magnetized, so it takes no electric power to keep the shot in place; a pulse of current through a coil can demagnetize the ring and let the shot pour out. A second ring of soft iron can be variably magnetized to meter out shot if desired. A total power loss is the worst emergency that could occur, says Piccard. If that happened, the shot could be released through a hydraulic gate pumped by hand.

Piccard is confident no serious emergency will arise. It's certain that one exciting moment will be the end of the trip, when the sub surfaces in the rough North Atlantic. The *Ben Franklin* will be heaving, rolling, and pitching as a small boat comes over from one of the escort ships. After the towline has been secured, Piccard and his companions will transfer to the small boat.

The sub and the boat are going up and down," says Piccard, demonstrating with his hands. "There comes a moment when the two are together—that's when you jump." ★ ★ ★

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## DISTRIBUTOR VACUUM ADVANCE

(Continued from page 155)

will make the timing mark appear stationary.

If there is flutter, however, timing has to be reset. Loosen the distributor housing, and turn the housing *against* rotor rotation to advance timing—with rotor rotation to retard timing. With the pointer aligned with the timing mark, retighten the distributor and recheck the setting.

### Timing light tests

Before checking on the functioning of the advance unit, disconnect the timing light from No. 1 cylinder and connect it to the sparkplug of the alternately firing cylinder. On V8 engines, this will be No. 5 cylinder in the firing order. On in-line engines, it's No. 4 cylinder in the firing order.

Check timing. There should be little or no variation in timing between the two cylinders. If you find there is more than a 3° variation, a problem with the distributor cam is indicated. It's probably worn.

Reconnect the vacuum line to the spark advance, and reconnect the timing light to No. 1 cylinder. Gradually increase the speed of the engine as you watch the timing mark, which should advance smoothly by action of the centrifugal advance.

To check whether the vacuum advance unit is working, pull and push the vacuum hose off and on the unit as you watch the timing mark. If the spark advance is working properly, the timing mark will shift rapidly.

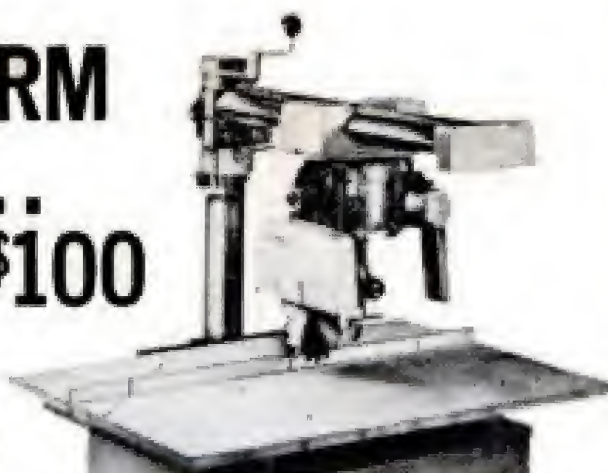
If this test indicates that the spark advance unit is not working, it will have to be replaced. First step is remove the distributor from the engine. Note the position of the rotor contact. When the distributor goes back in the engine the rotor will have to be in this position. As an aid, lay a pen or sharp pointed tool along the rotor contact and scribe a line, if possible, on a suitable adjacent surface. Rotor and scribe line should line up when the distributor is reinstalled.

Unbolt the distributor. (You may require a special wrenching tool). After lifting the distributor from the engine, you'll find two bolts which secure the spark advance unit. One attaches the distributor ground wire to the link between the spark advance and breaker plate. The other bolt attaches the link to the breaker plate. Remove both and slide off the spark advance unit. Be very sure that you replace the vacuum advance unit with one specified for your car. ★ ★ ★



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## HOW TO MAKE BAD WATER GOOD

*(Continued from page 187)*

before exhaustion, works anywhere and sells for \$13.95.

● *Hard water into soft.* There's an old wives' tale that water is purified by going through the ground. True, it may lose a few bacteria, but it picks up other troublesome materials. Water that trickles through limestone dissolves calcium and magnesium minerals. This dissolved rock, or hardness, makes shaving difficult and shampooing futile. It combines with soaps and detergents to create insoluble scum instead of dirt-suspending lather. This scum can't be rinsed completely from hair or skin, and after bathing, it shows up as a sticky ring around the tub. It makes laundry gray and rough, instead of refreshingly clean and soft.

Heat hard water, and some of the hardness minerals are forced out. They clog your water heater with an insulating layer that runs up your bills.

Back in 1905, a German professor discovered a way of removing calcium and magnesium, the two hardness minerals, from water. He did it by exchanging them for the sodium contained in "zeolite," and the water-softening industry was born. The zeolite is recharged periodically with common salt, and the hardness minerals are flushed down the drain.

The result is "softened" water rather than soft water. Naturally soft water, like that in sections of the Northwest and New England, is low in minerals and usually acid in character. Typical softened water retains its original alkaline character and original concentration of minerals. But it has the wonderful cleansing ability of naturally soft water.

● *Three ways to get soft water.* You can buy the equipment, rent it or subscribe to a soft-water service.

The service arrangement is the simplest. The softener service company merely installs some valves in your water line and hooks up a portable softener unit. Since a softener requires recharging periodically, a freshly charged portable unit is installed and the exhausted unit is taken back for the recharging process. At the plant, the portable softener is thoroughly cleaned and restored to full softening capacity by flushing with a solution of common salt. It may cost as little as \$4.50 per month.

If you buy a softener, it may cost you \$300 to \$500, but if your water is very hard, or if you use large amounts of water, you'll come out ahead. Modern softeners are completely automatic. They recharge themselves, using salt from a storage container. Even salt delivery is available on a

definite schedule in most areas. And the latest softeners are more efficient and economical. Here's why:

Until recently, automatic water-softener recharge cycles were controlled by "calendar clocks." Every few days, on a preset schedule and at a preset time, the clock would initiate a recharge cycle. This system had drawbacks. If you were away and used no water, the softener would still recharge itself on schedule. But, if you had a number of guests and used more water than usual, the softener could become exhausted.

Now an "Aqua-Sensor" has been introduced which detects the need for recharging in much the same way that a thermostat detects the need for a furnace start-up. This efficient system may save 40 percent of the salt and 50 percent of the water needed for recharging. Most important, you don't ever run out of softened water. The drawing on page 187 shows how the sensor works.

● *Combination water conditioners.* Culligan recently introduced a new group of all-purpose water conditioners. Called "Ultra-Cleer," they will handle several combinations of special water problems.

One model treats hardness and acidity. Another treats iron, sulfur and hardness, while a third treats iron, sulfur, acidity and hardness. These all-purpose units sell for about \$500, plus installation, or can be rented for about \$10 a month, plus the cost of salt and treatment materials. ★★

## SAVING HOME WEAR AND TEAR

*(Continued from page 179)*

seven straight lengths costs \$4.97. The latter lock in place, while the roll type fits under the shingles.

Another point of wear and tear is where water gushes from a downspout near the foundation. If allowed to form a puddle, the water not only will undermine and wash out foundation plantings, but also find its way into the basement through cracks in the wall. A downspout extension such as Scatter Rain will prevent puddling. It simply caps the end of the pipe, causing the water to sprinkle. It sells for \$1 and is made by Nichols.

Any time you can keep youngsters from making numerous trips into the house during the summer saves wear and tear. Here is where an outside drinking fountain will help. A clever one by Camco Manufacturing Co. screws onto any standard outside sill cock and has the added feature of not interfering with the use of a garden hose. It comes in two models at \$4.95 and \$6.95. ★★★



## WILL EAGLES SCREAM AGAIN?

(Continued from page 135)

sist of. The guess is that the cars will be reworked wedge designs powered by variations on a theme by Ford. Drivers will be '68 Grand Prix champion Graham Hill (who won at Indy in '66) and F/1 star Jochen Rindt.

### Turbines still trying

Despite rule changes that STP bossman Andy Granatelli claims knocked turbines out of contention at Indy, at least one such car will try to make the race—the Jack Adams car Glenn Bryant built last year but couldn't get ready in time for qualifying. The turbine being used is the Allison 250, a lightweight (139 lbs.) engine Bryant says will move his ultralight chassis at more than competitive speeds. The driver has not as yet been announced.

Speaking of Granatelli, he'll be on hand with two cars for Art Pollard, one a backup. Power will be a 318-cu.-in. Plymouth passenger-car engine Granatelli claims can be modified to put out 525 hp. Chassis will be the '68 four-wheel-drive turbocars he campaigned last season.

Regardless of what chassis/engine combinations make the race, they'll have to be mighty quick about it. Leonard won the pole last year in one of Granatelli's Turbocars with a four-lap record speed of 171.559. Just making the race in 33rd position was Larry Dickson with a speed of 161.124. This year, prerace guesses peg the pole speed at close to 175, with about 168 being needed to make the grid. For an idea of just how fast that is and what's happening at Indy, in 1965—four short years ago—A. J. Foyt won the pole and set a qualifying record speed of 161.233.

### Series began in 1911

In all, this year's race ought to be a dilly. Indy always is, being rich and colorful and crusty in tradition. The '69 race will be the 53rd in a series dating back to 1911, the only exceptions in this string being the war years of 1917-18 and 1942-45.

The race never fails to bring out racing's Establishment and hundreds of thousands of its die-hard fans, all of whom gather as if they were attending an annual rite to pay homage to and thrill to the skill and daring of the men who literally "lay it on the line" with every lap they make.

This year, more so than ever before, Indy is no place for strokes; the only conceivable strategy for the race calls for a driver to put his right foot all the way down—hard—and steer left. ★★★

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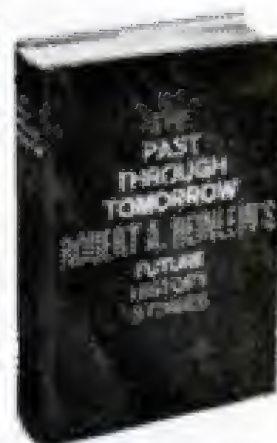


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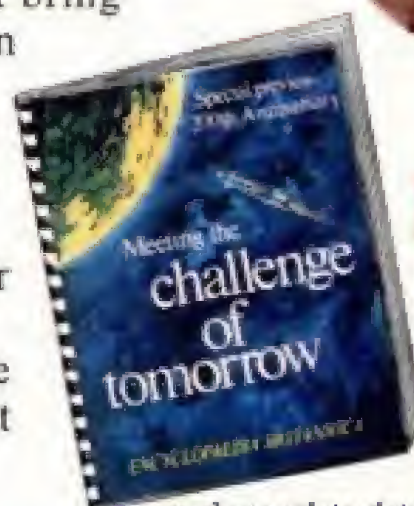
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